THE BOOK of KNOWLEDGE

LORD NELSON IN THE CABIN OF THE VICTORY

This picture by Charles Lucy shows Lord Nelson, in the full dress of an English admiral, seated in the cabin of the Victory. Nelson was one of the greatest admirals the world has ever known. With the battle of Trafalgar ended all hope of France's resistance to England at sea, but Nelson lived just long enough to know that his great task was accomplished. He paid the price of the victory with his own life.

The Book of Knowledge

The Children's Encyclopædia

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CONTENTS OF THIS VOLUME

This is a short guide only to the principal contents of this volume. It is not possible to give the titles of all the Poems and Rhymes, Legends, Problems, color pages, questions in the Wonder Book, and many other things that come into the volume; but in all cases the pages where these parts of our book begin are given. The full list of these things comes into the big index to the whole work.

WHAT THIS STORY TELLS US

THERE is no food question that people differ so strongly about as the eating of meat. And we know that different animals have very different opinions on this subject, too. Some people even think it is wrong to kill animals for their flesh, but most people think it not wrong so long as the animals are killed mercifully. Nearly all well-to-do people eat too much meat; everyone who knows is agreed about that. As for children, they need even less meat than grown-up people do, and often suffer even more severely than grown-up people from taking too much meat. Fish is a cheap and good kind of meat, and eggs are, of course, animal food, just as milk is, though people call themselves vegetarians who could not get on for a day without milk and its products. Eggs, as we learn here, are very good for children, as they are for everybody. It is a pity that, like animal foods in general, they are not cheap.

THE VALUE OF MEAT AS FOOD

CONTINUED FROM 3183

THE kind of food that we must now study is a very important one, whatever the real truth about it may be. Very nearly all of us like meat, it has such a great deal of taste, and even when we are taking other things, we like a little meat flavor in them. Now, there are several arguments of one kind and another why we should not eat meat, and there are several which suggest that we should eat meat. One thing is quite certain, at any rate, and that is that we are wrong if we make up our minds before we have looked at the facts. There is a special word, *prejudice*, which literally means "judging before," that is, to decide before we have a right to judge; and in this question of eating meat most people are prejudiced. We must try to be fair, and to follow the truth wherever it leads.

In the first place, let us consider the most important of all the arguments, and that is whether it is right to take life for the purposes of food. Some religions have taught that it is wrong. There are parts of the world where a man will move the tiniest worm or insect out of the path, lest someone should tread on it, and where it is regarded as wrong to take life of any kind, even the life of a poisonous serpent or biting insect. Perhaps the truer idea is that it is wrong to take life for pleasure, but that it may be quite right to take lower forms of life in order to serve higher forms of life; perhaps it is wrong to kill a serpent just for fun, but it is certainly right to kill a serpent to save a child.

Now, when we eat meat, of course it means that an animal has been killed. This is true also when we eat an egg, for the egg is a very young animal. But no one really objects to the eating of eggs, because we know that when we kill the egg, which we do when we cook it, we inflict no cruelty. That, surely, is the real question. In the case of the sheep or the ox, then, we have to remember, first, that in any case the animal must die some time, for all living creatures are mortal. If we kill it without pain and instantly, that is far more merciful than if the animal were allowed to die of disease or old age, and a thousand times more merciful than Death is in his dealings with mankind; and we may say that while the animal was alive it enjoyed its life, and that though we brought the animal into existence for our own purposes, yet it owes to us the happiness it had during its life.

This means that the highest question regarding the eating of meat is the question as to how the animals are killed. Whenever there is reason to suppose that animals are killed less quickly than need be and with some cruelty—either by carelessness or to save expense, or because the meat

looks nicer, or for any other reason—then we should protest, and say that we will not eat meat unless we know that the slaughter-houses are as good as they can be in this respect. But if these conditions are complied with, then surely we may say that so far from our practice of eating meat being a cruel one, it really means conferring the pleasure of life upon a great many creatures which would otherwise not have come into existence at all, and that the only price which they have to pay is the price which all creatures must pay for life, and that the smallest possible—a painless, unfeared death.

So now, if we always remember this question about the killing of the animals, I think we may regard the moral question as satisfactorily settled, and may go on to study the good and bad results of meat-eating simply as a question in the science of the body. There are, first of all, some very interesting arguments derived from the study of life, which we ought to know.

SOME CLEVER ANIMALS THAT EAT FLESH, AND OTHERS THAT EAT GRASS

When we study the higher animals, it is not possible to prove from their diet that it is better either to eat meat or not to eat it. It is true that the carnivorous, that is, the flesh-eating, animals are very intelligent, quick and graceful in their movements. We can see this with both the big cats and the little cats at the zoos, and it is, of course, interesting to compare their quickness with the slower movements of herbivorous, or grass-eating, animals, like oxen and sheep.

We know, too, that one of the most intelligent of animals is the dog, which is really a tame kind of wolf, and is carnivorous. But there are animals more intelligent than the dog: these are the monkeys and the apes, and none of them eat flesh. The truth, I believe, is that the quickness and intelligence of the flesh-eating animals is not derived from the flesh they eat, but is due to the fact that animals which live by hunting other animals must be quick and intelligent, if they are to live at all.

The intelligence of the higher apes is the highest in the world, with the exception of our own. Yet fruits and nuts, and other vegetable foods like them, make up their food. Their teeth and ours are very closely alike; they are, indeed, the same in number and arrangement, and differ only in small details. They are certainly not the teeth of animals meant to seize and kill other animals. It is true that the gorilla has huge canine, or eye, teeth, but they are for fighting other gorillas, and not for carnivorous purposes.

THE MAN-LIKE APES THAT LIVE ON FRUIT AND NUTS

So, as far as that goes—as it is possible that the higher apes and mankind are descended from a common ancestor—we might argue that human beings ought not to eat meat. But that would not be a right argument. In the first place, we find when we study the apes that, though they are not beasts of prey, yet if meat is given to them, they soon learn to like it very much, and thrive exceedingly well upon it; and also a well-known student of the subject has produced evidence which makes us think that, as man has grown in intelligence, his diet has passed from the fruit and nut stage to include meat. So as far as all this goes, though it is very interesting, it is not conclusive in any direction.

Another kind of argument has been based upon comparing different races of men, and also different individuals, with one another. People say that the races that eat the most meat are the leading races of the world, and want us to believe that it is the meat that makes them the leading races of the world. Others say that the races that eat most meat are the brutal, war-like oppressors of the world, and want us to believe that it is the meat that makes them brutal. Now, the question is: Are the facts as they are stated, and would they mean what they are supposed to mean if they were really the facts?

MEN OF MUSCLE AND MEN OF MIND WHO EAT NO MEAT

Almost the most important truth about man, as we have already learned, is his amazing power of adaptation. The vegetarians in our own country have shown us, during the last half-century, that, without the use of meat, it is possible to make athletic records, and to turn out splendid and vigorous works of the mind. They have proved that, and we have to recognize the fact, whether we like it or not. It used to

be said that it we did not eat meat we should become weaklings, soft in body and mind. This is not true, and we have to admit that it is as possible to be strong, both in body and mind, without meat as with it.

SOME PEOPLE WHO SHOULD EAT MEAT AND SOME WHO SHOULD NOT

On the other hand, nobody has yet begun to prove that we should necessarily become stronger, either in body or mind, if we ate no meat. The truth probably is that the great majority of people can adapt themselves equally well to either kind of diet, if they go wisely about it. Also, there is a certain number of people who are so made that it is much better for them to eat meat, while others are better without meat. But, apart from exceptional people, let us see what facts we may be sure of.

It is certain that the *color* of meat proves nothing as to its use. Nothing makes such good red blood as white milk. The redness neither of meat nor of red wines has any virtue for the making of blood. The only important point about the color of meat is that white meat, like the breast of a chicken, is more easily digestible than red meat. This is true also of many kinds of fish. All the meat we eat is made of muscle fibres, and muscle fibres vary very much in size and length. The smaller and finer they are, the more easily are they digested; but all white muscles are not easily digested, for the muscle fibres of such a creature as the lobster are very tough and thick, and very difficult to digest.

We learn, then, that the color of muscle food, in general, proves nothing as to its value. There is some meaning, however, in the *taste* of it. When a food is liked, we know that it is specially liable to call forth the digestive juices, and that is a real recommendation.

THE GREAT FOOD-VALUE OF MEAT SOUP TO SOME PEOPLE

It has also been proved that, even apart from taste, the flavoring substances in meat are more powerful in calling forth the juices of the stomach than any other food. Careful experiments have been made by a great Russian observer, and of all the substances tried, none calls forth the juices of the stomach either in such quantity or in such strength as meat does. From this it follows, in the case of people whose appetite really needs to be helped, that it is sensible to begin a meal with a little clear meat soup. Clear meat soup contains no food matter at all, the food part of meat being tasteless and solid, but it does contain the substances which help the stomach to do its work. Is not the fact that the flavoring matter of meat has this effect upon the stomach a very strong argument in favor of the view that our bodies are naturally adapted to eat meat?

The true food-value of meat depends upon the tasteless, colorless, odorless albumen which makes up the greater part of it, and, secondly, upon the salts it contains. Extracts contain merely the flavor of the meat, omitting all the food except the salts.

THE WILD RUSH OF THE GRASS-EATING ANIMALS TO OBTAIN SALT

It is interesting to know that vegetarian animals, who do not get enough salt in their food, are known sometimes to rush wildly for miles to places where salt can be obtained. These places are sometimes called salt licks. Every creature must have salt, and especially sodium chloride, which is common salt, in its blood. Muscle is rich in sodium chloride, and so animals that live on muscle get enough of it.

It is very important that we should know how far meat is useful for children, and so we must specially discuss that now, as it is really more useful for us in this book than the general question about the use of meat. First, children, like all other living things, differ from one another; one child will like meat, and another will dislike it. Now, in so far as these likings and dislikings are natural to the child, they should very largely be trusted. If the child is in health, and has not had its taste perverted, its body, of which the appetite is the voice, probably knows what is good for it better than other people are likely to guess. *But* we ought to be sure that we are dealing with natural appetite, and not with something that has been made by the special way in which the child has been fed. Many children, indeed, probably most children, if they are regularly and carefully offered highly flavored dishes, gravies, and beef

extracts and soups, and so on, will very soon grow to like meat very much, and will probably be inclined to take much less than they should of foods which, at any rate for them, are simpler, safer, and better. We have Nature's guidance, after all. The food she provides for the child when it is very small has practically no flavor at all. Neither the mouth nor the stomach of a healthy child requires food to be highly flavored.

THE FOOLISHNESS OF FORCING MEAT UPON YOUNG CHILDREN

Where a child does not care for meat, nothing could be more foolish than to force meat upon it. The appetite of the child that does not care for meat much is far more likely to be the natural unspoiled appetite than not. Meat is a necessary food for no one; it has its risks for all, and least of all is it especially good for children. Probably, the less meat a child has, the better; and nothing is more certain than that if a child be properly fed in other ways, especially with abundance of milk, it suffers no loss of strength or vitality from the omission of meat.

The flavoring substances of meat are of the nature of stimulants, not only to the digestion, but also to the brain. As Baron Liebig said, they make us aware of our strength. Doubtless, this often gives a real value to meat and to preparations of meat in the case of grown-up people, but there is a time to stimulate and a time not to stimulate. Something is always very wrong somewhere when a child needs a stimulant. The natural, healthy child is a perpetual motion machine, except when it is asleep, and its splendid activity puts most of its elders to shame.

WHY LITTLE CHILDREN SHOULD NOT EAT MUCH MEAT

Lucky, indeed, are the grown-up people who have something of the child left in them in this respect, as in many others. Grown-ups may perhaps want stimulants to make them like children, but the problem of the child is rather, if there is any problem at all, to prevent it from becoming too excited, and to persuade it to go quietly to bed. In these days, especially, children are apt to become excitable, and then, of course, they have to pay the price for being over-excited. They do not sleep deeply enough, perhaps they have dreams, or even wake up suddenly, terribly frightened. In many cases it will be found that if we have the wisdom to stop giving the child the stimulants which it does not need, and which are only bad for it, we shall cure these troubles. No child should have tea or coffee, as we shall see later, nor any but very small quantities of meat and preparations of meat. We need not fear that the child will suffer. There is no lack of strength or vitality about the gorilla or the elephant or the horse; and these get their strength without eating muscle. The biggest and strongest flesh-eater amongst men is no match for any of these, so far as physical strength is concerned.

It seems now quite certain that well-to-do people, both in this country and in England, eat far more meat than they need, and far more, indeed, than is good for them. As meat is a highly expensive food, this is, of course, a waste from the point of view of money; but the stimulating substances in meat are capable of injuring the body, if they are taken too freely, and that is more serious than injuring the purse.

THE GREAT DIFFICULTY MEN HAVE IN BECOMING TRUE VEGETARIANS

We may fairly say that all the work that has been done on the subject of food for a number of years has been in the direction of lessening the importance of meat, reducing the amount of it that is thought desirable to eat, and strengthening the case of the people called vegetarians. It is fair to remember, however, that very unsatisfactory results follow the attempt to live on a really vegetarian diet. So-called vegetarians take milk, which is an animal food, of course, and which, with its various products, butter and cream and cheese, makes all the difference to them.

Of course, the herbivorous animals, except when they are very small, take neither milk nor eggs, and are genuine vegetarians. But most vegetable food, such as grass, contains only a very small proportion of real food substance in it, therefore the quantity that has to be eaten is very large, and the business of digesting is very serious. We find, then, that the ox, for instance, has to have a very complicated stomach, which takes

up a great deal of room, and strongly contrasts the shape of its body with the shape of, say, a greyhound's body—for the greyhound lives on concentrated muscle food, and its digestive organs can afford to be quite small. So human vegetarians are apt to have not the most elegant of figures. Also, it can easily be proved that the digestive organs of man are nothing like so capable of dealing with vegetable food as are those of such an animal as the ox. They are not so large or so complicated, nor so strong; and they cannot produce nearly such powerful juices.

ANIMALS THAT HAVE TO KEEP EATING ALL THE TIME THEY ARE AWAKE

Still more interesting is the question of time. The herbivorous animal has practically to spend the whole of its time eating, when it is not asleep. I do not say that this is so if we supply it with specially nutritious kinds of vegetable food. But if we allow for the labor and time required in digesting as well as for the time required for chewing, in the first place, we shall soon see that the vegetarian has to devote far more of his life to eating than the person who takes his food in a more concentrated and more digestible form, and who, therefore, has far more time to devote to the real business of living; for we human beings, at any rate, must eat to live, and not live to eat.

Fish is, of course, really a form of meat. It is a very good food, very cheap—unless we choose to pay for flavor—and the eating of large quantities of it is less liable to injure the body than is the case with butcher's meat. There is no truth in the notion that fish has a special value for the health of the brain. Fish does not contain more phosphorus than other kinds of meat, as used to be supposed.

THE GREAT VALUE OF EGGS AS A FOOD FOR MAN

Eggs are excellent food. We know what the egg becomes, and everything that makes up the body of the living chicken must have been in it except for a certain amount of oxygen, which was breathed in through the eggshell. White of egg very largely consists of water; indeed, only little more than one-tenth part of it really consists of albumen. The yolk of egg is by far the most nourishing part, and nearly one-third of it consists of fat. The form in which fat occurs in the yolk of egg is one which enables it to be very readily digested, compared with many other kinds of fat. Eggs are very rich in phosphorus and in calcium and in iron. In all these respects the yolk is much superior to the white. The yolk of egg, therefore, is a very specially good food for people whose blood is poor, and it has no superior for rickety children. In both cases, of course, we assume that it can be digested. No food, except milk, contains so much calcium as yolk of egg does, and it is true alike of the calcium, the iron, and the phosphorus that they are very easily taken in by the body.

The less an egg is cooked, the more easily it is digested. A hard-boiled egg stays in the stomach more than three hours—about twice as long as a lightly boiled egg. Practically the entire food substance in eggs is absorbed by the body—a great contrast with many foods, much of the food substance of which never gets into the blood.

THE BEST KINDS OF FOODS FOR BOYS AND GIRLS TO EAT

We cannot look upon eggs as cheap, unfortunately. They might, perhaps, be cheaper than they are if their value were better known and the supply were better organized. Like milk, eggs are highly to be recommended for children of all ages, and one may begin giving a little of the yolk of egg to a child after the first year of life. The best sources of proteid for children of all ages are milk first and foremost always; then oats and wheat, eggs, fish, chicken; and, at the bottom of the list, a little lightly cooked meat. Milk and its products, and yolk of egg, are also the best sources of fat that can be found.

It was shown by careful measurement upon a large number of factory children that, "between thirteen and sixteen years of age, they grow nearly four times as fast on milk for breakfast and supper as on tea and coffee."

We have now learned something about the more important foods upon which man depends for the building up of his body. We must next consider some of those substances which we eat and drink, but which are not really true foods.

THE NEXT PART OF THIS IS ON PAGE 3413.

THE LITTLE GREY BIRD IN THE BRANCHES

They went together to the wood where the nightingale used to sing, and half the Court went with them. On and on they went till they reached the wood, and the little girl stopped before a tree. "There she is!" said she. "Listen, listen! There she sits!" And she pointed to a little grey bird up in the branches.

THE EMPEROR'S NIGHTINGALE

CONTINUED FROM 3210

THE palace of the Emperor of China was the most magnificent in the world. It was made entirely of fine porcelain, exceeding costly, but at the same time so brittle that it was dangerous even to touch it. The emperor's garden extended so far that even the gardener did not know the end of it.

Whoever walked beyond it, however, came to a beautiful wood with very high trees, and beyond that to a lake. The wood went down quite to the lake, which was very deep and blue; and among the branches dwelt a nightingale, who sang so sweetly that even the poor fisherman, who had so much else to do when he came out at night-time to cast his nets, would stand still and listen to her song.

Travelers came from all parts of the world to the emperor's city; and they admired the city, the palace, and the garden; but if they heard the nightingale, they said: "This is best of all." And they talked about her after they went home, and learned men wrote most beautiful verses about the nightingale of the wood near the lake.

These books went round the world, and one of them at last reached the emperor.

"What is this?" he said. "The nightingale! I do not know it! Can there be such a bird in my garden without my having heard of it?"

So he called his gentleman usher. Now this was so grand a personage that no one of inferior rank might speak to him; and if one did venture to ask him a question, his only answer was "Pish!"

"There is said to be a very remarkable bird here, called the nightingale," said the emperor. "Her song, they say, is worth more than anything else in all my dominions. Why has no one ever told me of her?"

"I have never before heard her mentioned," said the gentleman usher. "She has never been presented at court."

"I wish her to come and sing before me this evening," said the emperor. "The whole world knows what I have, and I do not know it myself!"

"I have never heard of her," said the usher, "but I will seek her."

But where was she to be found? The usher ran up one flight of steps, down another, through halls, and through passages, hoping to find someone who knew about the bird. Not one of all whom he met had ever heard of the nightingale, and the usher returned to the emperor and said:

"It must certainly be an invention of the man who wrote the book."

"But the book in which I have read it," returned the emperor, "was sent me by the high and mighty Emperor of Japan, and therefore it cannot be untrue. I wish to hear the nightingale; she must be here this

evening, and if she does not come, the whole Court shall be flogged."

"Tsing-pe!" exclaimed the gentleman usher; and again he ran upstairs, and downstairs, through halls and through passages, and half the Court ran with him; for not one would have relished the flogging.

At last they met a poor little girl in the kitchen, who said:

"Oh, yes, I know her very well!"

"Little kitchen maiden," said the gentleman usher, "I will procure for you a sure appointment in the kitchen if you will conduct us to the nightingale."

So they went together to the wood where the nightingale used to sing and half the Court went with them.

On and on they went till they reached the wood, and the little girl stopped before a tree.

"There she is!" she said. "Listen, listen! There she sits!" And she pointed to a little grey bird up in the branches.

"How simple she looks!" said the gentleman usher.

"Little nightingale!" called out the kitchen-maid, "our gracious emperor wishes you to sing to him."

"With the greatest pleasure," replied the nightingale; and she sang in such a manner that it was delightful to hear her.

"Most excellent nightingale!" said the gentleman usher, "I have the honor to invite you to a court festival which is to take place this evening, when his Imperial Majesty will doubtless be enchanted with your delightful song."

"My song would sound far better among the green trees," said the nightingale. However, she followed willingly when she heard that the emperor wished it.

There was a general cleaning and polishing at the palace; the walls and the floors, which were all of porcelain, glittered with a thousand gold lamps; the loveliest flowers, with the merriest tinkling bells, were placed in the passages; there was a running to and fro, which made all the bells to ring, so that one could not hear one's own words.

In the midst of the great hall where the emperor sat, a golden perch was erected, on which the nightingale was to sit. The whole Court was present, and the little kitchen-maid received permission to stand behind the door, for she had now actually the rank and title of "Maid of the Kitchen." All were dressed in their finest clothes; and all eyes were fixed upon the little grey bird, to whom the emperor nodded, as a signal for her to begin.

The nightingale sang so sweetly that she touched the hearts of all who heard her, and the emperor was so delighted that he said: "The nightingale shall have my golden slippers and wear them round her neck." But the nightingale said:

"I have seen tears in the emperor's eyes. That is the greatest reward I can have."

Yes, indeed, the nightingale's success was complete. She was now to remain at court, and to have her own cage, and all the city was talking of the wonderful bird.

One day a large parcel arrived for the emperor on which was written "Nightingale."

"Here we have another book about our far-famed bird," said the emperor.

But it was not a book; it was a little piece of mechanism, lying in a box—an artificial nightingale, which was intended to look like the living one, but was covered with diamonds, rubies, and sapphires. When this artificial bird had been wound up, it could sing one of the tunes that the real nightingale sang; and its tail, all glittering with silver and gold, went up and down all the time. A little band was fastened round its neck, on which was written: "The nightingale of the Emperor of China is poor compared with the nightingale of the Emperor of Japan."

"That is famous!" said everyone; and he who had brought the bird obtained the title of "Chief Imperial Nightingale Bringer." "Now they shall sing together; we shall have a duet."

And so they sang together; but the song was not a success, for the real nightingale sang in her own way, and the artificial bird produced its tones by wheels.

"It is not his fault," said the artist; "he keeps exact time, and sings quite according to method."

The artificial bird then sang alone. He was quite as successful as the real nightingale. And then he was so much prettier to look at; his plumage sparkled with jewels, silver, and gold. Three-

and-thirty times he sang the same tune, and yet he was not weary; and every-one would willingly have heard him again. However, the emperor now wished to hear the real nightingale sing. But where was she? She was gone and no one had seen her as she flew, out of the open window, back to her own green wood.

"What is the meaning of this?" said the emperor; and all the courtiers abused the nightingale, and called her a most ungrateful creature. "We have the best bird, at all events," they said. And for the four-and-thirtieth time they heard the same tune; but still they did not quite know it, because it was so difficult.

The real nightingale was banished from the empire; but the artificial bird had its place on a silken cushion, close to the emperor's bed. All the presents he received, gold and precious stones, lay around him; he had obtained the rank and title of "High Imperial Dessert Singer."

Thus it went on for a whole year. The emperor, the Court, and all the Chinese knew every note of the artificial bird's song by heart; but that was the very reason why they enjoyed it so much—they could now sing with him.

But one evening, when the bird was in full voice, and the emperor lay in bed and listened, there was suddenly a noise, "bang!" inside the bird; then something sprang, "sur-r-r-r!" all the wheels were running about, and the music stopped.

The emperor sprang quickly out of bed, and had his chief physician called. But of what use could he be? Then a clockmaker was fetched, and at last, after a great deal of consultation, the bird was in some measure put to rights again; but the clockmaker said he must be spared much singing, for the pegs were almost worn out, and it was impossible to renew them. There was great lamentation, for now the artificial bird was allowed to sing only once a year.

When five years were passed away, a great affliction visited the whole empire. The emperor was ill, and it was reported that he could not live.

Cold and pale lay the emperor in his magnificent bed. The floors of all the passages were covered with cloth, in order that not a step should be heard; it was everywhere so still—so very still. But the emperor was not yet dead. Stiff and pale he lay in his splendid bed, with the long velvet curtains and heavy gold tassels. Death sat at the emperor's bedside, and the emperor was afraid. A window was opened above, and the moon shone down on the emperor and the artificial bird.

"Music, music!" cried the emperor. "Thou dear little artificial bird, sing, I pray thee, sing! I have given thee gold and precious stones; I have even hung my golden slippers round thy neck! Sing, I pray thee, sing!"

But the bird was silent; there was no one there to wind him up, and so he could not sing. Death continued to stare at the emperor with his great hollow eyes; and everywhere it was still—fearfully still.

All at once the sweetest song was heard, and the room became filled with such beautiful sounds that Death could not stay. The music of the real living nightingale could vanquish Death, who, like a cold white shadow, flew out at the window.

"Thanks, thanks!" said the emperor. "Thou heavenly little bird, I know thee well. I have banished thee from my realm, and in return thou hast brought me back to life. How shall I reward thee?"

'Thou hast already rewarded me," said the nightingale. "I have seen tears in thine eyes, as when I sang to thee for the first time. Those I shall never forget; they are jewels which do much good to a minstrel's heart. But sleep now, and wake strong and well. I will sing thee to sleep."

And she sang, and the emperor fell into a sweet sleep. Oh, how soft and kindly was that sleep!

When all the people knew that their emperor was whole again, their joy knew no bounds, and the little nightingale was the most popular person in the land.

The emperor begged her to stay with him and live in the palace, but to this she would not consent.

"I must be free," she said. "But in the evening, when you are alone, I shall come and sit in a tree by your window and from there sing to you of the good and evil of the world, and fill your mind with beautiful, helpful thoughts."

PRINCESS FLORINA

PRINCESS FLORINA was so beautiful that, when King Charming saw her portrait, he fell in love with her, and came with his minister to ask her hand in marriage. Unhappily, Princess Florina had a wicked stepmother and an ugly stepsister, who was called Troutina because her face was as spotted as a trout's skin. When King Charming arrived, the stepmother took him to Troutina, whom she had arrayed in the richest robes and the loveliest gems which she possessed.

"But where is Princess Florina?" said the king, frowning. He saw her sitting in a corner, dressed in calico, and hastened to her and said, with a tender smile:

"Princess, you do well to dress plainly. Beauty such as yours needs no adornment."

"Don't waste compliments on Florina," said the stepmother. "She is a very vain girl. Look! Dear Troutina is waiting for you."

The king, however, stayed beside Florina, and talked with her for three hours, and talked so sweetly that he won her heart.

But when he came next morning he could not find her. The stepmother had shut her in a high tower. King Charming then resolved on desperate measures. He bribed a maid to show him the window of the chamber in the tower where the princess was imprisoned, and he came there at night with a carriage and a long ladder, and climbed up to the window. A veiled girl appeared, and he lifted her down and put her in the carriage and drove off with her.

"Take me to the lodge in the forest," she said. "My godmother lives there, and she will help me."

They reached the lodge, and a dwarf opened the door, and showed the king and the veiled girl into separate rooms. The wall between the rooms, however, was very thin, and the king heard two voices speaking, and listened.

"How did you manage it?" said the first voice.

"Oh," said the second voice, "a maid told me that the king had bribed her to show him where Florina was imprisoned! So I removed the princess into the garret, and went into her chamber and veiled myself, and King Charming came and carried me off in her stead. Having eloped with me, he cannot now refuse to marry me."

"But I do refuse!" cried the king, striding into the next room, where he found Troutina talking with a witch.

"Wait!" said the witch. "You have not yet been asked to marry my goddaughter. I will teach you first to esteem her, and when she deigns at last to offer you her hand, you will not refuse it."

Striking the king thrice with her wand, the witch danced around him, and sang:

> He who flirts and flies away
> Shall have wings to carry him!
> Shrike and hawk and shrieking jay
> Hunt him down and harry him!
> Till the maid he slights to-day
> Condescends to marry him.

King Charming at once changed into a blue bird, and flew out of the witch's lodge into the forest.

The next morning, when Princess Florina opened her window, a blue bird flew down with an emerald ring in its beak, and put the ring on the window-sill, and then perched there and sang to her so sweetly that she said:

"Charming! Charming!"

"Ah, you still know me!" said the blue bird. "Yes, dearest, I am King Charming. I have been changed into a bird because I would not marry vile Troutina."

"And I have been imprisoned because you are in love with me," said the princess. "But never mind. We can now see each other more often than we could before."

"Put this ring on your finger," said the blue bird. "I flew into my rooms early this morning to get it for you. It is an engagement-ring."

The princess kissed the blue bird very tenderly, and put on the ring.

"Now," said the blue bird, "I will return and fetch a bracelet I had made for you."

But Troutina had seen the blue bird enter Princess Florina's chamber, and she had got a fierce hawk, which she flew at the blue bird as it came out of the window. Happily, King Charming's minister, who had been searching every-

where for his master, chanced to be passing, and he picked up the poor blue bird as it fell wounded to the ground.

Being a wizard as well as a minister, he was not at all astonished when the blue bird spoke to him and said that it was the king. On learning all that had happened, he took the blue bird to the witch, and said that King Charming would marry Troutina in a week's time, if he were at once healed and restored to his own shape; and with three strokes of her wand the witch undid her spell.

"Keep the witch quiet by preparing for the wedding," said the minister to the king, "and I will find another wizard, and the two of us will outwit her."

Troutina and her mother set out for King Charming's palace, where the marriage was to take place, and Princess Florina escaped from the tower and followed them, saying sadly to herself: "I must see him and return the ring."

When she reached the palace the people had assembled to see the wedding procession, and, owing to a strange commotion inside, she was able to enter unperceived. On reaching the great hall, she saw two pigs rushing about, with the witch, very much excited, running after them.

"It's no use," the king's minister was saying to the witch. "There is another wizard here besides me. Troutina and her mother have been turned into pigs, and pigs they shall remain."

THE WITCH RAN AFTER TROUTINA AND HER MOTHER, WHO HAD TURNED INTO PIGS

"On with the wedding procession!" cried King Charming, catching sight of Princess Florina. "The real bride has come." And, kissing Florina, he led her to the royal carriage, and as they drove to the cathedral all the people shouted "Hurrah!" and danced and sang with glee, because the king was going to marry the beautiful princess whom he loved so much.

SIR TRISTRAM OF LYONNESSE

A STORY OF KING ARTHUR'S TABLE ROUND

TRISTRAM was a king's son, and dwelt at Lyonnesse. He was famous at his father's court for his beauty, his courage, and his skill at music. But his stepmother hated him out of her jealousy, and the king sent Tristram to the court of the young man's uncle, King Mark of Cornwall, so that his stepmother should do him no injury.

Now, in Cornwall, Tristram found King Mark and all his knights in a state of fear. They had refused to pay tribute to King Anguish of Ireland, and the terrible knight, Sir Marhaus, had arrived with ships, and now lay off the coast challenging the bravest of Mark's knights to meet him in battle. None durst fight the great Irishman, and Mark bit his lips with rage. Then the beautiful Tristram of Lyonnesse said: "Make me a knight, and I will meet this Sir Marhaus."

So Mark made him a knight, and the strong youth, henceforth to be famous throughout Christendom as Sir Tristram of Lyonnesse, went out to encounter Sir Marhaus. They met on an island, and when Sir Marhaus saw how young was this knight, he courteously bade him think twice before meeting death so early.

But Tristram answered boldly, and their horses clashed together. Long was the fight. Both men were dashed from the saddle, and fought fiercely on foot. The lance of Sir Marhaus pierced the side of Tristram, and the blood flowed in a river; but bravely did the boy fight on, and at last, raising his sword, he brought it down on the head of Sir Marhaus so that it crashed through the skull.

Thus Tristram won his first fight. But his wound was sore, and it was said that to heal it he must needs go to the land of him who had dealt the blow; so Tristram passed to Ireland. Now, as he lay off the coast of that country, he sat upon deck playing the harp, and the music reached one who ran to King Anguish with the news of it, and King Anguish sent for Tristram. Tristram, who had slain Sir Marhaus, brother of the Irish queen, called himself Sir Tramtrist, and was welcomed by the king, the queen, and their daughter, the fair Isolt. To Isolt Tristram taught music, and she tended his wound, and they were like brother and sister together.

Now, at the court was a Saracen of enormous strength, by name Sir Palamides, who, although a heathen, did yet overthrow the knights of Christendom, and was proud and haughty and disdainful in his bearing. This man

THE GOOD SIR TRISTRAM DISCOVERS HIMSELF TO KING ANGUISH

teased Isolt with protestations of love, and would not take the maid's "Nay," but must always declare that before long she would love him.

So, one day, being at a tournament, for Isolt's sake, Tristram met this boaster; and Tristram, who wore white armor and rode upon a white horse, crashed against Sir Palamides in black armor and mounted on a black horse, and with his lance drove the Saracen over his horse's tail, and only spared his life on condition that never again would he pester the fair Isolt.

Then Tristram returned to Cornwall; but his uncle, who sought a wife, sent him to Ireland to bring back the fair Isolt, that she might be Queen of Cornwall. Now, on the way back to Cornwall with Isolt, as he lay at her feet on the ship's deck harping, Tristram grew thirsty, and seeing near him a flask, he gave it first to Isolt to drink, and then himself drank. Now, this was a love potion made by Isolt's nurse for Mark and Isolt only; for those who drank of this magic wine loved each other for ever after. And so it came to pass that when Tristram looked next upon Isolt, and Isolt looked upon Tristram, they loved each other with a great love, and were afraid.

Sir Tristram gave Isolt to King Mark, and then rode away and became Knight of the Round Table. And it came to pass that one day as Isolt walked in the forest, the Saracen suddenly appeared, and by guile carried her off. But as they rode through the forest a knight challenged Sir Palamides, and while these two fought, Isolt crept away, and was presently found by one who carried her to his castle in all honor. Then came the furious Sir Palamides to the castle, and sat down before it like one mad.

But Tristram, who had heard of Isolt's danger, rode up before the castle, very terrible and calm, and gave battle to Sir Palamides. The din of their fighting reached Isolt, and she looked from the window; and when she saw the Saracen stretched upon the green grass, and Sir Tristram standing over him with lifted sword, she cried to him to spare. And at the sound of her voice Tristram grew pale and shook exceedingly, for he loved her dearly. Then, on condition that Sir Palamides became a Christian and joined the brotherhood of King Arthur, he spared him, and Sir Palamides lived to be a very gentle and honorable Knight of the Round Table.

THE BRAVE SIR TRISTRAM OF LYONNESSE, WHO DEFEATED THE SARACEN KNIGHT

This photograph and that on page 3282 are by Messrs. Ellis and Walery.

Then Sir Tristram carried Isolt to King Mark, and tarried long at the Court of Cornwall. But King Mark hated Tristram; and one day, as Sir Tristram harped to Isolt, Mark sprang from a hiding-place and clove Sir Tristram through the skull. But the death of Tristram broke the heart of the fair Isolt, and she faded away and died.

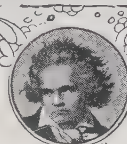
THE NEXT STORIES ARE ON PAGE 3365.

HOW HAYDN PLAYED WHILE VIENNA BURNED

When Napoleon's army was firing upon Vienna, two men sat listening to the guns that thundered through the streets. In a cellar sat Beethoven, vainly trying to shut out the sound of the guns from his ears, lest they should ruin his hearing and make him deaf to music; in another room Haydn struggled up in his bed, and with his dying fingers played the Austrian national anthem to try to drown the noise of the enemy's fire. The picture brought to our minds is a sad one. Haydn's last hours were made sorrowful by the invasion of his beloved country. Beethoven, who was already growing deaf, had his fears realized and was soon unable to hear with his outward ears the noble music that still sang on in his heart.

GREAT COMPOSERS OF MUSIC

CONTINUED FROM 3142



IT is rather curious that while the earliest times produced great writers of prose and verse, there were no really great composers of music until within the last three or four hundred years. The first composer treated seriously by the musical historians was Palestrina, who died in 1594. He wrote a Mass—that is, a musical setting of the Roman Catholic Church service—which the Pope thought so fine that he ordered it to be taken as the pattern for all the future music of the Church. But Palestrina's music never took hold of the people. The first great composer whose music did that was George Frederick Handel.

Handel was a German, born at the little town of Halle, in 1685. His father was one of those seventeenth-century barbers who were at the same time doctors and dentists. And he had made up his mind that his son should be brought up in the profession of the law. But music was in George's blood, and nothing would check his ambition to be a musician. He smuggled an old clavichord up to the attic where he slept, and at night, when all the others were in bed, he played and played, until he mastered the instrument. When this self-taught genius was only seven years old, the duke of Saxe-Weissenfels heard him play on the organ, and persuaded the boy's father to let him have good teachers, and do everything that he possibly could to help him forward in his chosen art.

In time Handel began to compose big works, mostly operas. But the operas had no great run on the continent, so he went to London and settled there. For long years he did almost nothing but write operas, and he generally rented a theatre of his own. He had some successes, but he had more failures; and, in fact, was twice bankrupt over his opera business. Yet, if Handel had not failed with his operas, we should never have had those great oratorios by which we know him now. For he turned to oratorio when he had exhausted himself with opera. An oratorio is a long composition for voices and orchestra, the words nearly always taken from the Bible.

Somebody has said of Handel that he set the Bible to music, and this is partly true. He wrote more than twenty oratorios, though not more than three or four of them are performed to-day. But one alone, of the three or four, would have been quite enough to immortalize the

name of Handel; for it is to him that we owe "The Messiah," heard all over the country every Christmas season. Just as we think of "Paradise Lost" when we think of Milton, or of "Robinson Crusoe" when we think of Defoe, so it is "The Messiah" that comes to our minds when we think of Handel. And he wrote it—this long work, which takes more than two hours to sing—wrote it, choruses, solos, accompaniments, and everything, in twenty-three days!

A GREAT GERMAN COMPOSER WHO IS BURIED IN WESTMINSTER ABBEY

Of course, he wrote other things that we like to remember besides his oratorios. Every young pianist plays his "Harmonious Blacksmith," for instance, and violinists and singers often have his name in their programmes. Sometimes, too, if we go to an organ recital, we shall hear a concerto of his. But, after all, he is *the* great composer of oratorio. The English are so proud of him that they like to claim him as English from his long residence in London. He was, indeed, a naturalized Englishman, and when he died, in 1759, they laid him beside their great men and women in Westminster Abbey, where we may see a monument representing him in the act of writing "I know that my Redeemer liveth" for "The Messiah." We may also see his house in Brook Street, Hanover Square. He had a fiery temper, used "bad words" sometimes, and once threatened to throw a disobedient singer out of the window. But he was pious and charitable too, and we like to know that he gave an organ, and much of the money he drew from his oratorios, to the Foundling Hospital. They have a new organ there now, but some of the original pipes of Handel's organ are built into it.

HANDEL AND BACH, WHOSE MAGNIFICENT MUSIC WILL LIVE FOR EVER

The greatest musician who was living in Handel's time was John Sebastian Bach. The two, Handel and Bach, are often spoken of as if they were a sort of Siamese twins of music. They were both Germans, and they were born within a month of each other. Both, again, were fine organists; both gave great religious works to the musical world; and both were stricken blind in their later years. Beyond that, they did not have much in common. Handel never married; Bach was a quiet, stay-at-home man, who married twice and had a family of twenty sons and daughters. His organ compositions, after all these years, are the most perfect things of the kind ever produced. One writer says they are "unsurpassed and unsurpassable." Bach is to music what Shakespeare is to literature, and just as it is the ambition of every actor to play Shakespeare, so it is the ambition of every organist to play Bach's great fugues.

In this connection there is a little story that may be told. Bach lived in the time of Frederick the Great. Now, Frederick was musical; he played the flute very well, and he took a notion to have a visit from Bach. So Bach, who was then over sixty, set out on the journey. The king was at supper when his arrival was announced. Springing from the table, Frederick broke up the meal with the words, "Gentlemen, Bach is here!" and took Bach, weary as he was with travel, through the palace. Bach played upon the piano, which was then a new invention, and improvised upon a little melody given him by Frederick. Then, at the end, he told Frederick that he *preferred the organ.*

THE GRAND OLD MAN OF THE ORGAN, WHOSE INFLUENCE LIVES TO-DAY

That was what Bach preferred; and we think of him mainly as the grand old man of that noble instrument, which musicians call the "king of instruments," and which we look upon as the only one great enough to use in our churches. Nevertheless, what is called his Passion Music is so great that singing societies have been formed for the express purpose of singing it, while every boy or girl who hopes to be a true musician spends a great deal of time in studying at the piano the work that Bach wrote for his well-loved clavier. He was the first musician to use all the fingers of the hand in playing on an instrument with keys. Before his time, musicians who played on the organ, clavier, and harpsichord, as a rule, used only the three first fingers. Bach commenced to use all five, and gave us our modern system of fingering.

Bach has had a great and lasting influence on all the great composers who have followed him. Beethoven was enthralled by his great B minor Mass. Mozart, by chance, listened to some of

Like many of the great composers, Haydn was very poor in his young days, and wandered about the streets of Vienna playing the violin to make a precarious living. Later he became rich and famous, and it was in England that his greatness was first recognized. Here we see him on his way to that country watching a storm, to which he afterwards gave realistic expression in his oratorios the "Creation" and the "Seasons."

Handel has been called the sublimest musical genius upon record. His father wanted him to be a lawyer, and removed all musical instruments from his house, but an old friend, when Handel was only six years old, had a clavichord taken to the top of the house, and upon this the child practised secretly at night after the rest of the family had gone to rest. The artist shows us the scene when he was discovered.

his compositions, and came away deeply impressed and wondering. Mendelssohn, Schumann, Wagner, Brahms—every one of them revered Bach as their godfather in music. Later musicians owe to him even more, for his work has become part of the language of music. This wonderful genius died in 1750, nine years before Handel, who mourned for him as for a brother. So much for the first pair of great composers. Now we shall take another pair—Mozart and Haydn. It has been remarked as strange that Bach and Handel, though they were born, both Germans, in the same year, and lived practically throughout the same period, never met. It was not so with Mozart and Haydn. They met often, and they were very fond of each other. It was Haydn who described Mozart as "the most extraordinary, original, and comprehensive musical genius ever known in this or any other nation."

That was a very generous tribute from one great musician to another. We shall deal with Haydn first, for he was called "Papa" Haydn, so much was he loved in his own day. And we, too, for other reasons, may well call him "Papa." He was the father of most of the instrumental forms of music which are now regarded as *fixed* forms—the symphony, the sonata, the string quartette, and the like. That is to say, he wrote works in these departments which every composer feels to be the right models to follow.

THE POOR PEASANT BOY WHO BECAME THE FATHER OF MODERN MUSIC

That, in itself, was a notable thing to achieve. And it was particularly notable for a poor boy who had to go out into the world to earn his own living at an age when boys nowadays are at school, enjoying their games, if not their lessons. The parents of this great composer were humble Austrian peasants, of the Croatian race, and they were living in a little house on the market-place at Rohrau when he was born, in 1732.

But Haydn had, at any rate, one advantage: his musical abilities, discovered in early childhood, were not thwarted by his father. The father arranged for the training of his young prodigy, and the young prodigy was taught his notes with many floggings when things went wrong. He developed a good voice, and was sent to sing in the choir of Vienna Cathedral. But the day came when his voice "broke," and he was of no more use to the choirmaster, who might have kept him resting until his voice "set"; but Haydn had displeased him. One day he played a boyish prank on a fellow-singer by cutting off his pigtail, and now he was dismissed from the choir and left to provide for himself as best he could.

You would not like to hear of all the hardships he endured for long after this. He became a great singing teacher's servant; he played the violin at dances and even in the streets!

THE HAPPY DAYS OF HAYDN'S LIFE AND HOW HE WROTE HIS BEST MUSIC

But he was perfecting himself in composition all the time; and the Countess of Thun admired his sonatas so much that she found for him a remunerative engagement, and introduced him to pupils who paid well. Henceforward he had no trouble in getting on. In 1760 he married, not very happily, and a year later he entered the service of the Esterhazys, one of the richest Austrian families of the time. Great families kept a permanent band of their own in those days, and Haydn was the Esterhazys' bandmaster. The post gave him a good salary and a comfortable home, and he went on with his composition under the most favorable conditions.

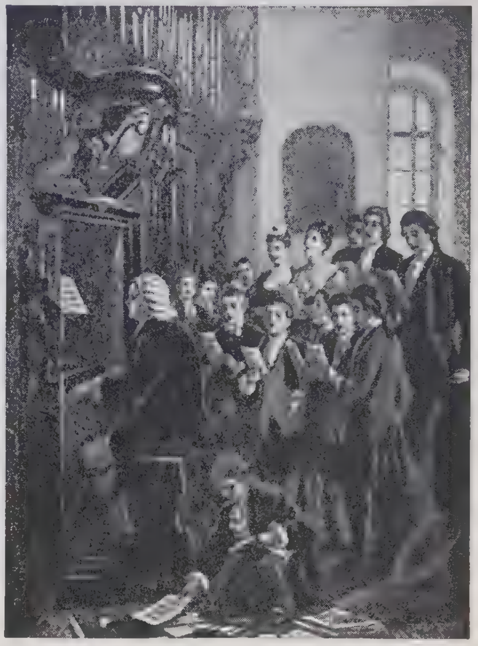
That was until 1790, when the Esterhazy orchestra was disbanded. Then he went to London on a visit, and wrote for certain London concerts some of those symphonies which we still delight to hear. Altogether he wrote about 150 of these symphonies. Mozart saw him just before he left, and wept at the parting. "We shall never meet again," he said; and it proved true. In the music of our Church hymnals we find a tune called "Austria," with Haydn's name attached. It is almost as well known as "God Save the King"; and it was after hearing "God Save the King" in London that Haydn felt he must make a national tune of the same kind for his own beloved Austria.

THE TENDER HOMAGE OF ONE GREAT MUSICIAN FOR ANOTHER

He went home and wrote "God Preserve the Emperor," and then somebody made the air into the hymn-tune that we have sung so often.

GREAT COMPOSERS AT THEIR INSTRUMENTS

Mozart, seen here with his father and sister, was one of the most remarkable musical geniuses that ever lived. When only five he composed music, and at seven could play difficult works without a mistake.



The world has never produced another master of the organ like Bach. When he played his listeners almost heard the instrument speak. We owe our system of piano playing with all the fingers to Bach.

Mozart's later years were very sad. He had made little money and had spent it all, and was constantly in debt. His health, too, was bad, and jealous enemies persecuted him. At last these things brought on an illness, from which it was evident he could not recover, and summoning a few friends to his bedside, he asked them to play over the magnificent " Requiem " he had recently composed. This they did, as shown here.

The bottom picture on this page is reproduced from the painting by Kaulbach, by permission of the Berlin Photographic Company.

And what else of Haydn's do we know? A good deal, I am sure. His symphonies are still played; his piano music is in all the publishers' lists; and his oratorio of "The Creation" ranks as a good third to "The Messiah" and "Elijah," of which latter we shall speak presently. Haydn wrote "The Creation" in his old age, and it was in listening to a performance of it that he made his last appearance in public. The excitement was too much for him. Pointing upward, he cried: "It came from thence!" They carried him away, and as he passed, Beethoven, who was there, bent down and fervently kissed his hand and forehead. It was a pretty and a tender act of homage.

Haydn's music is for the most part bright and genial, and even sparkling, with a dainty grace, and a constant melody, which was his most marked characteristic. Very superior persons will tell you that he toadied to princes and dukes and other important people, and wrote music merely for the moment. It is not true. Young people, at any rate, must always love Haydn and his music. It is bright and cheerful, and can always put us in a happy mood.

THE WONDER OF MOZART'S GENIUS AND HOW HE COMPOSED MUSIC AT FIVE

Young people should take a special interest in Mozart, for Mozart was a distinguished musician at a tender age. A young man once asked Mozart to tell him how to compose. The gentle Wolfgang Amadeus, for these were his Christian names, made answer that the questioner was too young to be thinking of such a serious occupation. "But you were much younger when you began," said the aspirant. "Ah, yes, that is true," replied Mozart, with a smile; "but then, you see, I did not ask anybody how to compose." No! Mozart was born in the city of Salzburg, in 1756, and he was only five when he composed a minuet and trio that boys and girls of much maturer age might play with some effect to-day.

His father was a good musician, specially expert as a violinist, and Wolfgang had a sister, Maria Anna, who, at first, showed nearly as much talent as he did. Hence they all—the father and the two children—started on a musical tour, in the course of which Mozart played before the Empress Maria Theresa, and romped with the little princess who afterwards became Queen of France—the unfortunate Marie Antoinette. These great ladies used to take him on their knee, and kiss him, and shower gold upon him. All the royalties, in England, made a darling of him and petted him greatly.

HOW MOZART BECAME POOR AND DANCED TO KEEP WARM

It was Mozart's happiest time, for, from the day that he began life in earnest as a married man—that was in 1782—the wolf of poverty never left his door. He composed incessantly, but even successful composition did not pay then as it does now, and the butcher and the baker often worried poor Mozart for a settlement of their accounts. A friend called one winter day, and found Mozart and his wife waltzing round the room. "We were cold," they said, "and we have no wood to make a fire." Let us think of that, and then think of the glorious works that Mozart produced under such depressing conditions. He left 769 compositions in all, and he was still under forty when he died.

In his own day he was regarded chiefly as a composer of opera, and we still think very highly of his "Don Giovanni," and "The Magic Flute," and "The Marriage of Figaro," though we seldom have a chance of hearing them. He wrote forty-nine symphonies, and conductors still like to have some of these played, particularly the so-called "Jupiter" symphony, and one in G minor, which has been described as his "tenderest and daintiest instrumental composition." All his works are full of charming melody, of which he had a fund only equaled by Haydn.

THE STORMY DAY WHEN MOZART WAS LAID IN AN UNKNOWN GRAVE

Mozart's end was very sad. He was taken ill in 1791, and during his illness he wrote a famous "Requiem," a sort of funeral song, which he had sung around his death-bed, to hear its effect. Then, on his funeral day, a great storm arose, and only the undertaker and his men went to the cemetery to see him buried. He died so poor that his remains had to be put into a pauper's grave, where many other coffins lay. Nobody looked for the grave for many years, and then it was found that nobody could point it out. So Mozart's monu-

ment in that great Vienna cemetery stands over an empty grave, while the composer's dust reposes no one knows where. It is pathetic to think of such an end of a great man.

There was another great composer who went through very much the same sufferings, the same persecutions and fate as Mozart. His name was Franz Schubert. "My music is the product of my genius and my misery," Schubert said. His people were poor, and he had eighteen brothers and sisters. Schubert's father was a schoolmaster, and probably attended himself to his son's early education. He also taught young Franz to play the violin, and an older brother taught him to play the piano. Franz soon got beyond the knowledge possessed by his home teachers, and by the choirmaster of the parish church. However, he gained admission to the choir of the emperor's chapel, where he was well taught, and quickly out-distanced his companions. Before he left the school, when he was about seventeen, he had written a symphony.

He began to compose at eleven, and he consumed as much music-paper as would have made a small fortune for a stationer. He wrote all kinds of things at that time—overtures, symphonies, quartettes, operettas, Church music, piano music, and so on. But now we remember him chiefly by his songs, and a few orchestral pieces.

GERMANY'S GREATEST SONG-WRITER AND HOW HE COMPOSED A FAMOUS SONG

He is Germany's greatest classical song-writer. He composed more than 500 songs, and is to the student of singing almost what Bach is to the student of the piano. The story of how he wrote some of his songs is of great interest. His lovely song, "Hark, hark the Lark," was written one Sunday afternoon while out on a walking expedition. He and his friends sat down to rest in a summer garden, and while waiting for refreshments, he picked up a volume of Shakespeare which lay on the table. The book opened at the song. The words started the flow of melody in Schubert's brain, and he wrote it on the back of a bill of fare.

One afternoon Schubert took up a volume of Goethe's works lying on his table. He read "The Erl King." The rushing sound of the wind and the terrors of the enchanted forest were instantly changed for him into realities. Every line seemed to flow into strange, unearthly music as he read; and, seizing a pen, Schubert dashed down the song nearly as we know it. He got a great singer to sing it, and then a Vienna music publisher, who had hitherto declined to have anything to do with his songs, asked to have it. He paid Schubert a very small sum, though in a few months the publisher made $400 out of it. That was the way with Schubert all along. Some of his finest songs were sold for the price of a meal. Grinding poverty, slights, disappointments innumerable, were Schubert's portion. He died in 1828, before he was quite thirty-two, and they laid him to rest near Beethoven, at whose death-bed he had shed tears, with this inscription on his tombstone: "Music buried here a rich possession and yet fairer hopes."

THE MIGHTY BEETHOVEN, WHO WAS TOO DEAF TO HEAR HIS OWN MUSIC

We have still to speak of Beethoven. Recall Haydn for a moment. When Haydn was dying in Vienna, in 1809, the French were bombarding the town. Haydn's servants were terrified, but Haydn took it all very calmly. He asked to be lifted from his bed to the piano, and when he was seated he played his own "Austrian Hymn" three times over, while the guns were thundering outside.

Now, at that very moment there was another composer in Vienna, crouching in a cellar, with cotton-wool stuffed in his ears. That composer was the mighty Beethoven. His hearing had begun to go, and he was afraid that the sound of the explosions would still further endanger it. Think of a musician being *deaf*! You might as well think of a painter being blind! Yet Beethoven, in some respects the greatest composer who ever lived, became almost totally deaf. The infliction embittered all his later years, and turned an originally lovable man into a kind of surly bear. Beethoven, like Handel, did not marry. He would throw the soup in his housekeeper's eyes when it did not please him, and stamp and rage and growl over the most trivial annoyances. Let us be charitable to him when we read of these things. It must have been awful not to be able to hear his own compositions.

THE HOME OF A BOY WHO WAS TO MAKE A NOISE IN THE WORLD

But Beethoven, apart from his deafness, had a very hard life. Born in 1770, at Bonn, that pretty little university town on the Rhine, where they have preserved his birthplace just as it was, he had to work his way up in a home directed by a father who was a confirmed sot. The father, who was musical, had heard something about the triumphs of the Mozart children in Vienna and Paris and London, and he thought he would make money out of his own Ludwig. So he set him to work at the piano, and visitors would often see the child late at night shedding tears over the keyboard. When he was about seventeen, he went to Vienna, where, it is said, Mozart gave him some lessons in composition. A few years later, he went again to Vienna to study, and made his home in that city for the rest of his life.

When Mozart first heard him play, he exclaimed: "Pay attention to this youngster, for he will yet make a noise in the world." We know now how true that prophecy was.

THE DEATH OF BEETHOVEN IN VIENNA AND THE BIRTH OF CHOPIN IN POLAND

Beethoven's works for the piano—particularly his sonatas—are the grandest things of their kind ever written. All the great pianists regard him as the king of composers for their instrument. And so, too, with the orchestra. Take away Beethoven's nine symphonies—the "immortal nine," they are sometimes called—and we should take away the *backbone* from the orchestra. He did not write very much for the voice, for he was essentially an instrumental composer; but he left one beautiful song, "Adelaide," and one great opera, "Fidelio." He passed away in March, 1827, and Vienna never before saw such a funeral as his, the crowds being so immense that the soldiers had to be called out to clear a passage for the procession.

There was another great composer for the piano, and he wrote the most poetical, dreamy, emotional things that we are ever likely to hear from that instrument. The name of this composer was Frederic Chopin. He was a Pole, born near Warsaw, in 1809, and his music seems to breathe the romance that we commonly associate with his nation. He was a consumptive, and died early, in 1849, after a long struggle with disease and weakness. There was something feminine about him, but perhaps that is just why we find his music so refined, and so full of emotion and grace. He is really the poet of the piano—nothing strong and grand about him, like Beethoven—with an ethereal grace and charm such as we find in no one else.

MENDELSSOHN, A GENIUS WHO WAS BORN TO WEALTH AND HAPPINESS

Another great composer who met him in 1834 gave him the significant pet name of "Chopinetto." This was Mendelssohn, a German Jew, born the same year as Chopin himself, by the way, who said of one of his pieces, "it is so perfectly beautiful that I could go on for ever playing it." One might say the same of several of Mendelssohn's own compositions. He was born to wealth and happy worldly circumstance, and never had to struggle with poverty or other ills. His music is bright and genial, clever and pure, manly and refined. His "Songs Without Words" are among the classics of the piano; and his oratorio "Elijah" ranks in popularity next to "The Messiah." It was written specially for the Birmingham Musical Festival—for Mendelssohn had a great affection for the English people, and liked London better than Berlin or Leipzig. He had a short life, but his early death, in 1849, seems to have been hastened by grief at the loss of a favorite sister.

A composer of a very different type was Robert Schumann, born at Zwickau, in Saxony, in 1810. There was no reason for his being unhappy, for his father was a publisher in easy circumstances. But there was a taint of insanity in the family. Schumann's sister died at twenty of an incurable melancholy; and Schumann himself spent his last years in a sanitarium, after trying to drown himself in the Rhine, near Bonn, where Beethoven was born.

SCHUMANN, WHO WROTE THE CHILDREN'S ALBUM, & WAGNER, WHO WROTE OPERAS

We can thus understand that his music is of a rather sombre cast. But we must remember, too, that he was the composer of that "Children's Album" of pieces with which every little player of the piano becomes acquainted. Schumann wanted to be a great pianist,

and to that end contrived a tiny machine of his own for exercising the third finger, which, we know, is not so supple as the other fingers. The machine hurt his hand, and he had to give up his ambition. But here again we have profited, for if Robert Schumann had been a great player, it is not likely that he would have been a great composer.

A Frenchman named Hector Berlioz, who lived at the same time as Chopin and Schumann, had a great influence on orchestral music as we know it to-day, and a famous conductor has said of him that "he exercised a weighty influence on musical art." We know him best as the composer of "The Damnation of Faust."

And now we come to the name of another of the great men who have done so much for music. This is Richard Wagner, whose music dramas are so well known, and who is the only one among all the later musicians who is great enough to stand with Bach and Beethoven. He is not a composer in whom young folks can take a very deep interest, because he wrote little but those great musical dramas upon which he prided himself so much, "Lohengrin," "Tannhäuser," "The Meistersingers," "The Flying Dutchman," "Tristan and Isolde," and the rest. He had an idea of his own about opera, and it was this—that the words are of equal importance with the music.

THE GREAT STORIES THAT WAGNER SET TO MUSIC

The older opera composers thought the music was everything, and the words of *their* operas were often silly to the verge of nonsense. Wagner changed all that, and if we read the words of his operas, we may enjoy the mere story perhaps almost as well as the music. He liked to deal with old German myths and legends, and we find his tales of Lohengrin and Tristan and Tannhäuser exceedingly interesting. He, too, was a German. He was born at Leipzig, in 1813, and had a very troubled career until King Ludwig of Bavaria took him up and gave him money and a home, which saved him to the world. He died in 1883, and he is buried at Bayreuth, where his final home was, and where he had created a specially constructed theatre for the performance of his works.

A FAMOUS RUSSIAN COMPOSER AND HIS WORK

Among the names of Russian composers, the name most familiar to us is that of Peter Tschaikovsky. Like many other musicians, Tschaikovsky had to overcome opposition before he was able to follow the bent of his genius. He learned to play the piano in his childhood, but it was not intended that he should be more than an amateur, and he was about twenty-one, and had been for some time a clerk in the Ministry of Justice at Petrograd, when his father suggested that he should study harmony. For this purpose Tschaikovsky went to the Conservatory at Petrograd, and very soon he gave up his work at the Ministry of Justice to devote himself to the study of music. There he used his time to such good purpose that when he was twenty-five, he was appointed professor of harmony at the new conservatory in Moscow.

Henceforth, until his death in 1893, his life was one of hard work combined with a struggle against ill-health and unhappiness.

He is best known by his orchestral work, and the fathers and mothers of some of our readers may have heard some of them conducted by the composer himself when he came to this country a few years before his death.

Now we may turn to an Englishman, Sir Arthur Sullivan—born in 1842, died in 1900—who, when he was studying at Leipzig, was believed by his teachers to be destined to become England's greatest composer. We cannot call Sullivan a really great composer; but, at least, he must have our thanks for all the pleasure he has given by his delightful comic operas. He fell short of true greatness in his grand opera and his oratorio work, but we never think of that when we are listening to the tuneful melodies, the bright, sparkling choruses, and the charming instrumentation of that long string of familiar works which he wrote.

SIR ARTHUR SULLIVAN'S FAMOUS OPERAS

In these delightful works, from "The Sorcerer" and "H.M.S. Pinafore," on to "The Gondoliers" and "Utopia, Ltd.," he successfully established something altogether new in musical art. His comic opera music "wears well," as we might say, and there is no reason

why his operas should not be as popular fifty years hence as they are to-day. Many people know Sullivan *only* by these operas. But he was a very versatile composer, and he wrote some fine hymn tunes which can never die. One of them we all know—the tune "St. Gertrude," sung to "Onward, Christian soldiers."

In Sir Edward Elgar, the English nation has a greater composer than Sullivan was, and some people think that he may be reckoned among the musicians of the world. It was not intended that Elgar should be a musician, and after he was twelve years old, he had no definite teachers. But his love for music was too great to allow him to adopt another profession. He had been brought up in a musical atmosphere—his father was organist of a church in Worcester—and he was able to go on and study by himself. The best works that he has written so far are his great oratorio, "The Dream of Gerontius," and an orchestral symphony.

A GREAT AMERICAN COMPOSER

Thus far we have studied only the names of European composers, but there is one American composer who may be included among the great musicians. This is Edward McDowell, who was born in New York in the year 1861. Curiously enough, like the greatest American sculptor, he was partly of Irish descent. Unlike some of the other composers of whom we have been reading, his life was a happy one, and although in the early part of his career he had not much money, he had few difficulties to overcome. He studied in New York until he was about fifteen, and then, as he showed signs of genius, his mother went to Europe with him. He studied first in Paris, and afterward in Frankfort, where he lived for some years, and wrote some of his earliest works. For a time he taught at Darmstadt, and then settled down with his wife in a little country house near Wiesbaden. Soon, however, his work became known in his native land, and after a time he came back to America to write and teach, and play in public, for not only did he write beautiful music, but he was a very good pianist. He first went to Boston and lived there for some years. Then he was called upon to go to New York to organize a department of music at Columbia University. In this work he was very successful, but, after a time, the task became too heavy for him, and he resigned. All these years, he had been writing music with all his might, as if he knew that the time he had to work was short. Not long after he left the university his health broke down, and he became a helpless invalid. He died in January, 1908, and was buried in Peterboro, New Hampshire, where he had made himself a beautiful country home. He was only forty-seven when he died, but he had left the world, among other things, a long list of beautiful songs, and some fine sonatas.

A NORWEGIAN COMPOSER WHOM CHILDREN LOVE

A modern writer whom we must not forget is Edward Grieg, of whom Norwegians are justly proud. Grieg was born in Norway in 1843 and died in 1907. We know him best by his works for the piano, and every young student is anxious for the time to come when he may study the "Peer Gynt" suite.

Among living German composers, Richard Strauss is the most famous, but opinion as to the greatness of his work is not yet decided. He has written a great deal of orchestral music, some operas, and some wonderfully beautiful music for the piano.

There are many more composers to write about. There is Gounod, for example, the Frenchman who gave us the always popular opera of "Faust." There is Rossini, the Italian who gave us "William Tell" and the world-famous "Barber of Seville."

Verdi, too, we ought to remember for his "Il Trovatore" and "Aïda," and later works of a more masterly kind, and Weber, also, for his "Der Freischütz," and Meyerbeer for his "Les Huguenots," and Donizetti for his "Lucia," and Bellini for his "La Sonnambula," and Balfe for his ever fresh and ever welcome "Bohemian Girl," and Bizet for "Carmen."

We ought to speak of Liszt, the greatest of all the great pianist-*composers*, and of Brahms, though his music requires much study and pondering, and is not very suitable for young people. Of these, the really great, we may say, in the words of Shakespeare, that they are "not for an age, but for all time."

THE NEXT MEN AND WOMEN BEGIN ON 3560.

LITTLE AGNES OF THE SNOW

CONTINUED FROM 3237

UP among the mountains in the Lake District of England, shown in this picture, there used to be a cottage where a man named Green dwelt with his wife and children. Agnes, the eldest, was nine years old when, one day in winter, her father and mother went to an auction in the neighborhood. The weather was fine when they started, and they kissed the children and told Agnes to look after the five younger ones, saying they expected to be back during the evening.

But, as gloaming came on, a thick mist settled down over everything, snow began to fall, and the children peered out into the gathering darkness and longed for their parents' safe return. Agnes was a brave little girl, and she did her best to take care of her brothers and sisters, gave them their supper, put the baby twins to bed, and talked to the others to prevent their crying for their mother.

By this time the snow was falling thick and fast, and soon it covered the path, and white lines showed under the door and through the crevices of the windows. Still there was no father or mother. At twelve o'clock Agnes heard her two brothers and little sister say their prayers, and then all crept into bed.

Next morning the cottage was nearly hidden by the snow, and still there was no sign of father or mother. Agnes busied herself dressing the children and getting their breakfast. Opening the door she gazed on the mountains covered with snow. Could she get through that snow? Suppose her father and mother were lying in it just a little way down the path there. Should she try to find them? She shouted, but there was no reply, and she dared not leave the little ones.

The third day dawned, and it was snowing harder than ever, hissing as it came down the chimney and nearly putting out the fire. Still the children were alone, shut away from father and mother and the whole world, while the brave Agnes looked after them as well as she knew how, and encouraged them to say their prayers as their mother had taught them.

By next morning the snow had ceased falling, and little Agnes made up her mind to go forth to find out about her parents and to get provisions for the little family. She could not cross the beck, but went a long way round to Grasmere. She told her story, a search-party was formed, and her father and mother were found dead in the snow. Everyone who heard the sad story and knew of the bravery of Agnes was anxious to help the orphan children, and they were well looked after.

THE BRAVE DIVER OF TORBAY

ONE summer day a torpedo-boat, practising in Torbay, Devonshire, came to grief, for her propeller shaft snapped and pierced her plating, so that the water rushed into her.

Some other boats came to her aid, but she sank in about half an hour. The crew, fearing the boiler would explode, had taken to the boats, and there, 150 feet down, the boat remained until it was decided to send divers to examine her.

Two men, Sidney Leverett and Walter Trapnell, came forward, and one light summer evening they were taken out, with all their diving apparatus, to where the wrecked boat lay.

Trapnell was let down first, and he soon sent up a telephone message that he had found the wreck. He was told to note the damage and to signal when he could be drawn up.

But no signal came, and the full twenty minutes, beyond which time it is dangerous for a diver to stay down at such a depth, had passed. What could have happened? The men in the boat pulled the life-line, but all they felt was a heavy weight.

Of the men in the boat, Sidney Leverett most keenly recognized that something serious was the matter with his mate. He sent down a message to ask what was wrong. Then, to his horror, he heard that Trapnell's lines were fouled, and he was unable to get clear. That meant that his friend was caught like a fly in a spider's web, and could not get away from the wreck.

Without delay, he slipped over the edge of the boat, and dropped down to the wreck. There he found his friend standing on the bottom, his life-line and precious air-tube entangled in the wreck. He worked hard trying to free him.

Every instant's delay added danger, for Trapnell had used up all the air available to him, and if he could not be freed soon, Leverett knew he would become unconscious and die. Every moment he himself was getting weaker and weaker, yet his friend's life depended on his quickness and skill. Once he felt it was hopeless to try any longer, but then he thought, "No, I cannot leave my mate. He must be saved. I won't leave him." So he struggled on patiently.

At last he set Trapnell free. Leverett signalled and sank into unconsciousness, while the men in the boat drew up the two divers very slowly, or the rush of fresh, pure air would kill them both. When they were at last freed from their diver's dresses, Leverett slowly recovered, but his poor friend, for whom he had risked so much, was so weak that he died the next day.

Yet the bravery, skill, and loyalty of Leverett had saved him from an awful death in darkness and loneliness at the bottom of the sea.

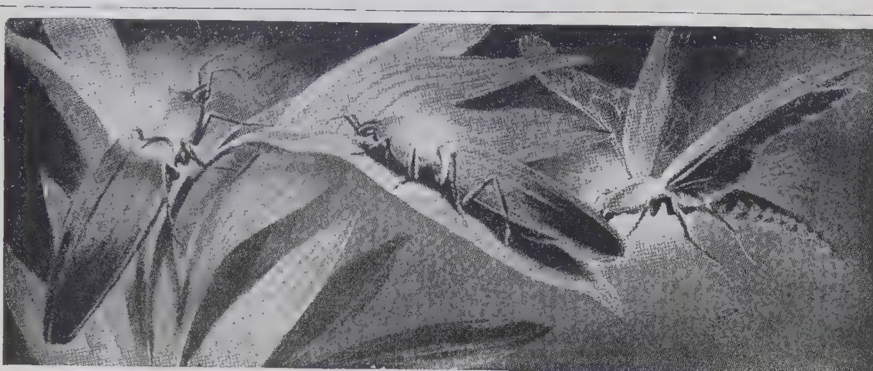
A GALLANT DEED OF A BOY KING

EVEN as a girl, Queen Elizabeth showed that independence of character which made her reign so remarkable. She and her little stepbrother, Edward, four years younger than herself, played together as children, and when they grew older, and were separated, the lonely boy missed the bright companionship of his sister, whom he called his "sweet sister Temperance." He was only a little boy of ten when he became king, and after that he rarely saw Elizabeth, and had to content himself with writing affectionate letters to her.

When he was only twelve years old he saved Elizabeth's life. One day, when the Thames was running high, the princess insisted on mounting her brother's horse, an animal only partly broken in. The horse dashed through the gateway, off in the direction of the river, and leaped over the palace wall into the water. Startled by the commotion, the boy king ran out to discover what was wrong, and when he heard what had happened to Elizabeth, he at once sprang into the saddle of another horse and followed her over the wall into the river. Good horseman as he was, he needed all his powers to reach his sister. She tried to spring on to his horse, but failed and sank. He dived after her, and, getting hold of his own horse, coaxed it to swim with them while he supported her, and at last the three got safely to the bank.

The photograph of Grasmere on page 3295 is by Mr. G. P. Abraham, Keswick.

THE NEXT GOLDEN DEEDS ARE ON PAGE 3593.



The fire-fly, which is really a beetle, flies by night, and lights up the tropical forests where it lives with a million tiny, moving lamps. Travelers are said to use fire-flies to light their path.

SOME INSECT FRIENDS OF MAN

CONTINUED FROM 3270

LADYBIRD

"WHAT'S the good of insects? You cannot plant them, and you cannot eat them." So said a member of Congress not many years ago, when it was proposed that money should be spent on protecting certain forms of insect life. Doubtless many farmers would say the same thing if a similar course were suggested to them. Many of them do not take the trouble to distinguish between harmful insects and those which are their friends.

There was once a stupid fellow who saw a toad, one of the best friends of the gardener.

"Toad, are ye? I'll learn ye to be a toad," he said, and brought down his spade, whack! on the poor toad's head. That is just the sort of thing that ignorant people would do with all sorts of insects. We have been studying some of the insects which are harmful to man, so we must be fair and look at the case of those which are our friends.

We shall take in more than insects, too, for we shall say a word for the humble worm, which is not an insect, as, of course, we know. Most people hate worms, and kill them when they can. Yet worms are industrious helpers of the farmer and gardener. Darwin studied their habits closely, and found that they help greatly in making our soil fertile. They eat the earth in which they live, just as the wood-borers eat the substance in which they make *their* homes.

The worms bring to the surface the earth which they have eaten. They make channels in the soil by which the air can enter and give the soil the nitrogen which it needs to make it fruitful. They carry down pieces of grass and straw, and these help the process. But most important is their work in bringing to the surface soil which has been lying below. Darwin found by calculation that the worms on a single acre of land bring up ten tons of dry earth to the surface every year.

Some savage peoples are really far wiser observers of Nature than we are. They realize the value of earthworms. When a native of the Yoruba country, in Africa, decides to cultivate new soil for a farm, for what sign does he look? He looks for the evidences of earthworms. Probably he has never taken the trouble to reckon up how much work the earth-worm actually does. He cannot go into figures as Darwin did. But he does know that the earth-worm makes the soil good for crops. So if he sees that worms are at work upon a tract of land, it is there that he sets to work to farm. If the land lacks worms, he knows that it is of no use to attempt to

farm, and he goes farther afield until he does find them. Probably few people who love the evidences of past civilization think that they owe anything to worms. But they owe a very great deal. The beautiful tessellated pavements which the Romans made in Britain have been preserved almost entirely by worms. They covered them with soil, in which the pavements lay secure for a thousand years. But for the worms these relics of the past must long ago have been destroyed.

The most charming of all the things which bear the name of worm is a creature which is not a worm at all—the glow-worm. The glow-worms, as they are called in England, are really beetles, and do good service.

THE MARVEL OF THE GLOW-WORM AND ITS WONDERFUL LAMP

The light is phosphorescent, and is produced from fatty cells, to which run many tubes carrying the oxygen necessary for the light. The operation of this light is as wonderful as the operation of the batteries of the electric fishes. The rays of light which the glow-worm gives off are said to possess the same properties as the famous X-rays—they will pass through solid substances through which the eye cannot see. Men can produce light by gas and electricity, of course, but they cannot do as the glow-worm does—produce light without heat. This humble beetle has a power which man cannot imitate.

All the energy that it uses goes to make light, none is wasted in heat. The male glow-worm has wings, and flies about on summer nights, showing his light frequently, but for short intervals. The female has no wings, but shows her light to attract her lover. He is delighted when he finds her; but she is very heartless, and when he arrives she continues to flash forth her light to attract other males, so that she may have a number of them buzzing about her to sadden the heart of the first arrival, her real sweetheart.

The powers of the light given forth by the glow-worm are very great considering how small the beetle is. Placed in the dark, the glow-worm yields a light strong enough to enable us to read print, or to tell the time by a watch. There are hundreds of species of this beetle and other light-giving beetles.

In Paraguay, there is a large beetle which, like the female glow-worm, has no wings. This curious worm-like beetle is three inches long, and gains its name by showing green lights along its body, and a red light at its head and tail.

THE FIRE-FLY THAT IS REALLY A BEETLE AND LIGHTS UP THE FOREST

When we see them in the daylight, our fire-flies are just ordinary little beetles, not unlike the soldier beetle, which is a first cousin. But in the bright moonlight, or better still in the soft velvety darkness of a summer night, they shine like fairy lamps. Beautiful as their light is, however, it is faint to the brilliant lamps hung out by the fire-flies of the West Indies, and the forests of Ceylon and of Central and South America. There they wing their way in countless swarms around the trees, lighting up the foliage as with gleaming diamonds. After rain the air seems filled with trains of flashing stars, which wheel about the tree-tops in glowing circles and make a scene such as might inspire the mind of poet or painter.

These wonderful creatures have their real use, as well as beauty, for the traveler. It is said that men who would not dare to pass, unlighted, through the forests of South America at night attach the fire-flies to their boots to light the path they tread. Thus lighted, a man goes on his way as in daylight, and when the sun gets up, he gratefully replaces his living lanterns on a shrub so that they may live to serve others in the same way.

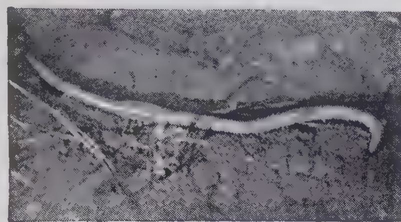
Certain birds use the fire-flies to light their nests. Natives make lanterns of them. Spanish ladies wrap them in gauze, and use them as ornaments for their hair; and young people decorate their dresses and the harness of their horses with them.

Most of these beetles are faithful friends of man, and, particularly when they are in the larva stage, eat up vast quantities of harmful insects, slugs and snails.

A LITTLE FLY THAT FIGHTS FOR MAN AND SAVES OUR GARDENS

We must leave these beauties, however, and pass to other noted families which are famous not for beauty but for service to man. These are the ichneumon flies of which we have read

THE WORM, THE LADYBIRD, AND SOME FLIES



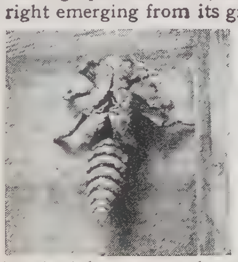
Although the earth-worm is sometimes a nuisance, it is one of the greatest friends of man, draining and ventilating the soil, and turning it over and over. The great scientist, Darwin, wrote a book about worms.

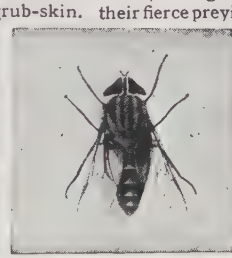
The ichneumon flies destroy many insect pests. The female lays her eggs in the larvæ of other insects, and these eggs hatch and the larvæ feed upon the victim. Here we have a caterpillar from which twenty ichneumons have emerged, the ophion ichneumon, and the long-tailed ichneumon.

On the left is a dragon-fly grub feeding upon an insect, and on the right emerging from its grub-skin.

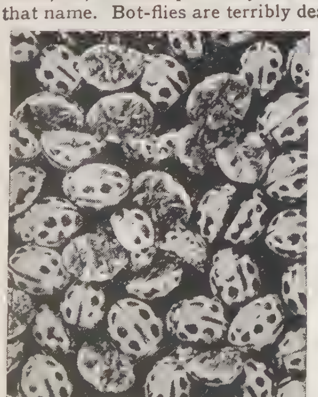
Born in water, the dragon-flies live in air, and get their name from their fierce preying on small insects.

This dragon-fly is at rest. Dragon-flies are sometimes called "horse-stingers," but do not sting horses.

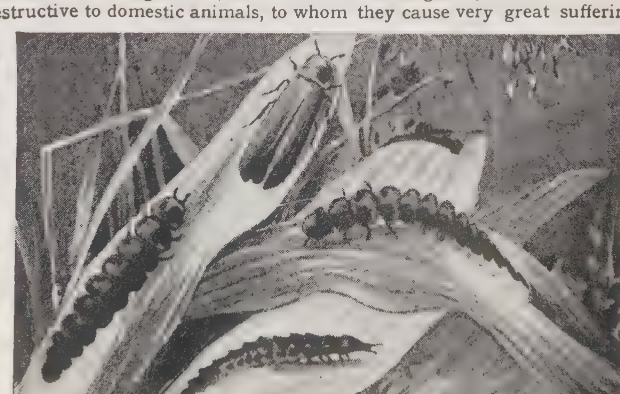




On the left we see a dragon-fly's empty chrysalis case. The other three pictures are the bot-flies of the horse, ox, and sheep. They are sometimes called gad-flies, and the harmless dragon-fly is also called by that name. Bot-flies are terribly destructive to domestic animals, to whom they cause very great suffering.



The gardener has no better friend than the ladybird, for it destroys the mischievous aphides. Here we see ladybirds that were wintering under a haystack.



Like the ladybird, the glow-worm is a beetle. It devours snails. Here we see the glow-worm and the beetle of which it is the larva. The female shows a much brighter light than the male, and this light, which is in the tail, will illuminate an inch or more round the creature. Old country people call glow-worms "stars of the earth."

The photographs on these pages are by F. P. Smith, W. P. Dando, B. Hanley, P. Collins, S. Johnson, D. English, W. S. Berridge, J. Ward, J. Lyle, and others.

of page 3018, the chalcis flies, and a family of tiny insects with a very long name, the proctotyrpes. These little insects all belong to the same great family as the bees and ants. The main group, which is called hymenoptera, is broken up into many divisions, and the great majorities of these smaller families are insect friends of man. The aid that man receives from the three families, of which we are now reading, the ichneumon flies, the chalcis flies, and the proctotyrpes, is almost beyond belief. There are thousands of species, and it is safe to say that men engaged in agriculture would be helpless without them. They lay their eggs in the bodies, or even in the eggs, of harmful insects, and so destroy these while multiplying themselves. How this is done we have seen in our story of the caterpillars. That is one way. The female has what is called an ovipositor. This is a sort of combined spear and tube. With the spear she makes an opening in the body of the insect in which she is going to deposit her egg, then, having made it, she produces an egg from the tube, and leaves it in the victim's body. Sometimes an ichneumon or a chalcis fly will lay its eggs in the body of another ichneumon, but generally they choose other insects, and chiefly keep each to its own class of victims. Let us watch an ichneumon at work on a rose leaf.

THE BATTLE FOR LIFE BETWEEN AN INSECT PEST AND AN INSECT FRIEND

Although the aphides make very good cows for the ants, they are terrible enemies of our rose-trees, whose leaves they spoil by robbing them of their life-juice. Down comes an ichneumon fly. She walks on her high, stilt-like legs, over the leaf until she sees a plump aphis. She touches it with her antennæ.

If the aphis were thus touched by an ant it would quickly produce some honey, but now it knows that a deadly enemy is at hand. It begins to wriggle violently to escape the doom which instinct tells it is near. The fly may wait until the aphis has finished wriggling, or may even give up and go to another victim. But in the end she is successful. One thrust of her lance in the back of the green-fly's neck makes the nest of the egg. In that wound the egg is placed, and the ichneumon, having fifty or sixty such eggs to place, hurries on elsewhere to continue her task.

The aphis does not die. It knows what has happened, and, leaving its companions, crawls away to a leaf to be all by itself. Presently the egg hatches, and the grub which leaves the cell lives upon the flesh of the aphis. We can only hope that the latter feels no pain. It seems a dreadful story, but naturalists suppose that the aphis suffers a sort of paralysis, which mercifully prevents it from feeling discomfort.

THE TINY FLY THAT KILLS THE FOES OF THE COTTON PLANT

When the grub has reached a certain size, the aphis dies. Then the grub makes its way out of the dead body and spins a silken cocoon for itself in which it undergoes changes, and finally comes forth as a winged ichneumon fly. In its turn it goes out to find aphides in which to deposit its own eggs. Without the aid of helpful insects, men would be helpless against the attacks of harmful insects, which if left unchecked would eat up all the green things that he cultivates for food. The blessing is that they make their attacks upon insects which are among the most numerous in the world, and from which we suffer most injury.

ENEMIES OF THE HESSIAN FLY AND BOLL WEEVIL

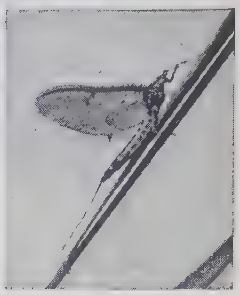
We have read of the great damage done by the Hessian fly. But the Hessian fly is preyed upon by several families of chalcids and proctotyrpes, which lay their eggs in the flaxseed pupa-cases of which we have read. Two or three little eggs may be laid in one flax-seed, which provides food for the larvæ until they are ready to turn into full-grown ichneumon or chalcis flies.

Even the dreaded boll weevil falls a prey to the busy little friends of man. It has been found that fast as this beetle travels to new fields, it is followed almost as quickly by myriads of enemies. It is calculated that about fifty species of insects prey upon the boll weevil, and more than half of them are chalcid and ichneumon flies which lay their eggs in the boll weevil larvæ. Our old friends, the ants help in the work of destroying the pests. They find their way into the boll, inside of which the young weevil is feeding, cut the young weevil up and carry it off in little pieces.

INSECTS THAT DO GOOD IN OUR GARDENS

The lace-wing fly lays each of its two or three hundred eggs on the end of a tiny hair. The larva eats plant lice.

A curious insect is the praying mantis, so called because the front legs are held up as in prayer. It is not found in the North, but in the Southern States. It is very useful in killing harmful insects.



The May-fly, related to the termite, spends two years in the water as a chrysalis, and dies the day it flies.

Here we see the life-history of the caddis-fly. On the left are the fully developed creatures, flying and at rest. Below is the grub, and the other figures are grubs emerging from the curious cases that they make for themselves. There are many caddis-flies in America, and they make their cases of different materials, some of twigs and leaves, others of grains of sand and stone, and one of the shells of water snails.

The ant-lion is an interesting creature. While in the larva stage it makes a pitfall in which to catch its prey. It hides at the bottom, with only the tips of its jaws appearing, and here it waits until an ant or other creature rolls down, when the ant-lion seizes and devours it. In the left-hand picture we see the ant-lion larva in its pit about to seize a victim, and on the right is the perfect ant-lion, which looks like a beautiful dragon-fly.

A FLY THAT HAS CROSSED THE OCEAN TO MAKE POOR FRUIT RICH

One of the little chalcid flies has given figs to California which now rival those of Smyrna. Smyrna figs have been from early times the best figs in the world. Farmers in California bought trees from Smyrna, and made them grow in California, but the fruit was not the same. Clever men of science studied the problem and solved the mystery. They found that the Smyrna fig required the aid of a chalcid fly, which makes its home on the caprifig. So caprifig trees were planted in California, and every year chalcid flies from these trees are brought to the Smyrna fig-trees. Naturally they enter the Smyrna figs to look for a place to lay their eggs, and in doing so, carry down into the fig-bud the pollen needed to make the seeds develop. Figs grown in California under these conditions are as good as those of Smyrna.

The ladybird is another of our friends in this country. People have such a horror of anything called a beetle that it is just as well that the ignorant do not know that the ladybird *is* a beetle, or, in spite of its great work for us, it would be killed by the stupid. We like to pet the ladybird because it is so pretty and so fearless. But its real value to us lies in the fact that it eats the insects which destroy our plants. They eat the aphides that are such pests in our gardens, and are strong allies of the fruit-growers in their efforts to get rid of the scale insects which infest our orchards. The young ladybirds are so unlike their parents that they might be in danger of being killed if people did not see them devouring the aphides. They look like tiny crocodiles when they first begin to run about the leaves on which they have come from the egg. Soon, however, it is seen that they are hunting aphides or eating scales, and then their mission is realized to be one of value. The ladybirds may be safely handled and examined, but if they are roughly treated or alarmed they have the power to emit a yellowish fluid with an unpleasant smell.

HOW A LADYBIRD SAVED THE ORANGE CROP IN CALIFORNIA

Scale insects are so called because many of them fix themselves fast to the tree on which they live, cover themselves with a shield of a wax-like substance, and may be taken for scaly bark. Under the comfortable shelter that they have made, they send down a long proboscis through the bark, and live by sucking up the life juice of the tree.

At one time, it was feared that all the orange-trees in California would be killed by a species of these scale insects, which had in some way been brought over from Australia. But, happily, someone thought that it would be a good thing to send for some of the ladybirds that feed on the scale in its Australian home. This was done. The Australian ladybirds throve and multiplied in California, and killed off the cottony scale so rapidly that the orange groves were saved.

This gave an idea to the melon-growers, who were growing discouraged by the ravages of the melon aphis. A family of Californian ladybirds go into their winter sleep, in great numbers, up in the mountains. In the fall and early spring men are sent to the mountains to collect quantities of these ladybirds. The insects are kept asleep in chilled rooms until the gardeners begin to complain that the aphides are increasing. Then the ladybirds are allowed to awake, and are set free in the warm sunshine in the Imperial Valley, to commence their work.

When it was found that the ladybirds had succeeded in keeping down the numbers of the orange scales in California, English hop-growers sent to New Zealand for ladybirds, in the hope that they could cope with the scale insects which were multiplying on the hop plants. Their effort was not a success, however. The climate did not suit the little visitors so well as that of their native land. They found the hop plants too high for them, and refused to seek higher than three feet from the ground. Finding the work so unsuitable for them, they gradually forsook the hops and worked away at the scale insects in the currant-bushes in the nursery gardens.

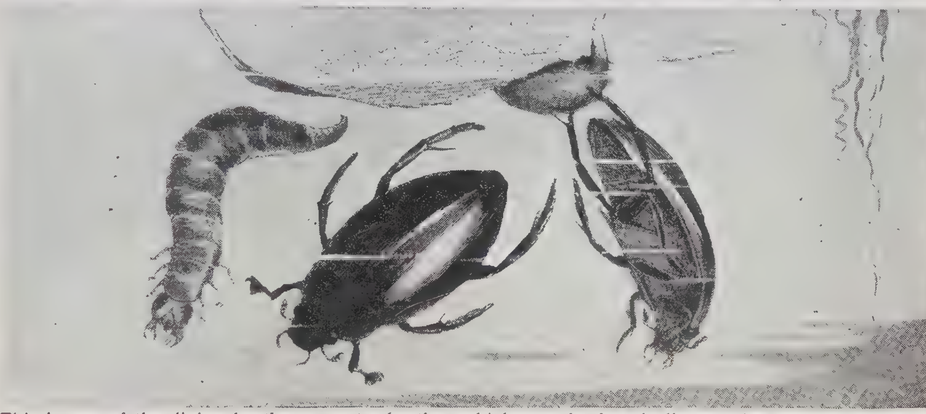
The beautiful dragon-fly is another of the creatures which are commonly misunderstood. It has a spear-like body, and when threatened curls this up and down as if it meant to sting. This might frighten a larger enemy; it certainly frightens ignorant human beings, who call it the "horse-stinger" and kill it, when they can, in the belief

SOME BEETLES THAT ARE USEFUL TO MAN

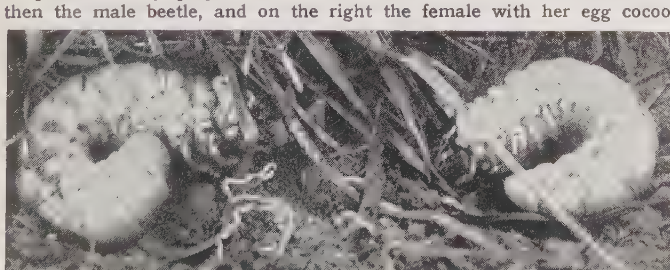
The tiger beetle is the most perfect example of a beetle that exists. No insect is more tiger-like in the way it preys on other small creatures.

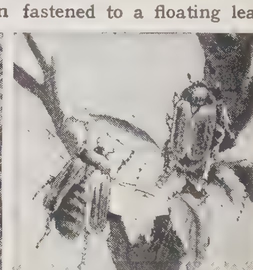
Here we see the tiger beetle's formidable jaws open. It rarely misses the prey it pounces upon, and is a most useful friend in our gardens.

The rove beetle, or devil's coach-horse, is so called from its wandering habits. When meeting an enemy it raises its tail, as shown here.

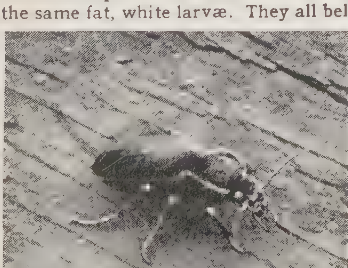


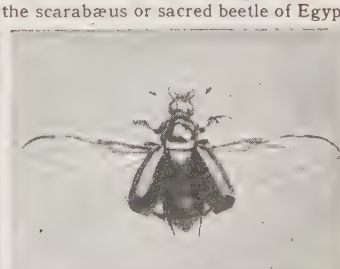
This is one of the diving beetles, or water beetles, which may be found all over the country in streams or ponds. They prey on other insects and even on small fish. On the left we see the larva, then the male beetle, and on the right the female with her egg cocoon fastened to a floating leaf.





These are two of the worst foes of the European gardener. On the left is the fat grub or larva of the cockchafer, and on the right, the summer chafer. These beetles, like our May beetles or June bugs, are very destructive to plants. Our rose chafer and vine chafer are related to the cockchafers, and their eggs hatch into the same fat, white larvæ. They all belong to the same family as the scarabæus or sacred beetle of Egypt.





The violet ground beetle, shown on the left, is a valuable friend of the European gardener, as it feeds largely upon cockchafer grubs. The cellar beetle of the middle picture is common in old houses in the old world. On the right is the burying beetle, shown at work on page 3307, with its wings extended.

that it is an enemy. They kill a very good ally by so doing. The dragon-fly, though it does not and cannot sting, is a sort of king of the insect world. It lives on other flying insects, and when we see it dashing about in the air like a flash of light, it is simply hunting prey which, if left, would injure us. Its powers of flight are marvelous, and it is impossible for a man even with a big, long-handled net to catch them when they are flying.

THE GORGEOUS DRAGON-FLIES THAT TRAVEL AS FAST AS TRAINS

They seem to know exactly what he means to do, and no matter how swiftly he may move, no matter how cunning he may be, they always manage to keep just out of reach of his net. They must be caught when at rest, if at all. It is the swiftness of their darting, swallow-like flight which makes them so certain of catching mosquitoes and other insects on the wing. They can catch insects when flying at the rate of forty or fifty miles an hour.

To enable them to make their rapid pounces in all directions, they need fine eyesight. And they have almost, if not quite, the finest eyes in the insect world. Their nearest rivals in this matter are the butterflies and day-moths. Not only are their eyes big; they are compound, made up of an enormous number of facets, each of which is an eye to itself. The dragon-fly has practically from 15,000 to 20,000 eyes in each of its eyes, and through each tiny angle can see as clearly as we can see with *our* eyes.

It must not be thought that the dragon-fly is an exception in having these marvelous compound eyes. The point is that the eyes of the dragon-flies differ in degree of strength, not in kind, from the eyes of other insects. Insects nearly all have these compound eyes. Our common house-fly, for example, has thousands of cone-shaped eyes bound into one big cone-shaped eye, and each facet is a separate self-working eye, though part of the greater eye.

AN INSECT WITH TWENTY-FIVE THOUSAND WINDOWS TO ITS BRAIN

The house-fly, as he darts across the kitchen or into the pantry, has 8,000 chances of seeing food or the cream-jug. The common beetle has 6,000 chances of seeing something worth looking at, while the mordella beetle has over 25,000 windows to its brain.

We must not leave the dragon-fly without a word as to the manner in which he came into the world. His life-story is similar to that of the mosquito. The eggs are laid in fresh water, and hatch there. The larvæ eat very hungrily, strong nippers in front enabling them to grasp and eat quite big insects and other forms of food. Their breathing is very curious. In a way it is like that of a fish. They have no windpipe or lungs, of course. The water enters the lower part of the body, where many little tubes extract from it the oxygen necessary to the insect's life. Then the water is forced out again, and the pressure of the water going forth is sufficient to drive the larva on its way without its troubling to swim by other means. When the time for a change comes, the larva crawls wearily up the stalk of a plant. He is feeling far from well. There he rests for a while. Suddenly the dull old coat in which he has been floating about splits down the back, and lo! a gorgeous dragon-fly creeps forth. He has wings now, small and damp and crumpled; he would be helpless if an enemy sought him. But he waits, and the sun dries him, and his wings harden and expand, and very soon he rises into the air in all the majesty of four splendid wings, and with a coat of mail bright and shining as the mail that the knights wore in days of old.

THE BEAUTIFUL DRAGON-FLY AND THE HARMFUL GAD-FLY

Sometimes we hear the dragon-fly called the gad-fly. There could not be a greater mistake. The gad-fly is a name sometimes given to the bot-fly, one of the greatest enemies we have. The horse-bot lays her eggs on the hair of the horse, in some place where the horse will be sure to lick itself. The eggs cling to the tongue of the animal and are swallowed. They remain in the stomach of the horse all the winter, and, leaving the body of the horse in the spring, burrow into the ground, and there become flies.

The ox-bot is more generally known as the warble-fly. This horrible creature serves the cattle as the ichneumon fly serves the aphis and caterpillar, boring a hole in the hide and laying its egg there.

Cattle are terribly afraid of the warble-fly, and will sometimes gallop themselves to death to escape it.

The sheep-bot is the worst of all, for this crawls into the nostrils of the sheep and lays its eggs there, where the grubs, on hatching, sometimes crawl into the brain of the poor sheep and kill it. The true gad-fly is the black horse-fly; but we must not confuse our gay friend the dragon-fly with either of these pests.

The dragon-fly and the mosquitoes are not by any means the only insects which undergo such surprising changes, being born in water, to fly in the air. The same course of life is followed by very many others with which we can afford to be on the very best of terms.

THE SNUG LITTLE HOUSE THAT THE CADDIS-WORM BUILDS

The caddis-fly, for example, deserves a chapter to itself, could we spare the space. The eggs hatch in the water in which they are laid, and the grubs are called caddis-worms, which fishermen are only too glad to secure for bait. They make the most wonderful nests for themselves in which to pass their days under water.

They gather bits of sticks and leaves, grains of sand, and tiny fragments of shell, and cement them all together to make the snuggest of houses. Some cut leaves and twigs into short lengths, and cement them together to form a tube. Others build up a home made of shells, in which the little animals to which they belong are already living, and the living molluscs are fastened round to make a live belt or shield for the caddis-worm.

Inside these tubes the caddis-worm spins a robe of silk which leaves its tail covered, but permits its head and legs to come out, so that the larva may collect its food of vegetable or animal substance. When they are to undergo their change, they close up this front door, either with plates of silk or with stones, so that the water may come through, but not animal enemies. Before the great change quite arrives, the larva must come out again, quit its cell for ever, and climb up on to a plant, where its shell will split open and it will appear as a pretty winged insect, the caddis-fly proper.

THE MAY-FLY THAT LIVES THREE YEARS IN WATER AND ONE DAY IN AIR

All this discussion of insect changes must have made us think of the life of the May-fly, or day-fly. The story of its life in the water is similar to that of the other insects of which we have been reading. But here the life in the water may last for nearly one, or even two or three years. In that time the larva lives a busy life, hunting and feeding on other insects, making itself dwellings in the sand or mud, and slowly, very slowly, preparing for the time to come. Finally, the great day arrives; the pupa stage has been passed, and the insect climbs out of the water all ready for flight, except that it is still wrapped in its pupal robe. This has to be worked off, and then the May-fly mounts into the air. The flies may be seen in millions and millions on a summer evening, dancing and eddying in the warm air over canal or pond or stream. Their lives in the air rarely last more than a day. Sometimes only an hour passes between the time of their leaving the water and their death. In that short time the females lay hundreds of eggs on the leaf of some water plant. Then they die. Their life in the air has begun and ended in, perhaps, an hour, after they have spent years in the water preparing for it. In some parts of Europe their dead bodies lie in such multitudes that they may be swept up and strewn on the fields for manure, while along the shores of the Great Lakes they sometimes form windrows miles long.

THE CUNNING ANT-LION THAT DIGS A PIT FOR ITS PREY

It is to this order of insects that one of the most extraordinary—the ant-lion—belongs. After it has undergone its change, the ant-lion becomes a pretty fly, but it is while in the larva stage that it most interests us. It makes a pitfall in which to catch its prey, and this is the way in which it does it: selecting a dry, sandy spot, it first marks out a circular furrow; then it places itself in the centre, and, half burying itself in the sand, it begins to dig. It uses one of its legs as a shovel; with this it throws up the sand on to its head, with which it jerks the material out of the circle and beyond the furrow. In the cleverest way it thus makes a tunnel down into the ground, funnel-shaped, two or three inches wide at the top, and narrowing down to the bottom.

When the work is finished, the ant-lion practically buries itself in the sand

at the bottom of the pit, and waits, listening, for an insect to come along. Presently, down topples an ant or something else; the ant-lion springs from its hiding-place, and, seizing the victim with its strong jaws, holds it until it has sucked all the juices from its body, then it throws the body out of the pit and waits for more. Should the prisoner be skilful enough to escape from the ant-lion and start to crawl up the side of the pit, the ant-lion at once flings up sand or earth with its head, and so causes the runaway to fall down again. These adventures suggest the doings of the trap-door spider, but we shall come to that in the next story.

THE PRAYING INSECT THAT HELPS MAN BY KILLING INSECT PESTS

We turn now to another famous insect, the praying insect, or praying mantis, as it is called. These do not live in the Northern States, but so many pictures have been published that we are all familiar with their appearance. Though they can fly, they do not pursue their food on the wing. They wait on trees or shrubs until an insect draws near. The head is bent down and inwards, the long, powerful front legs are folded and held up as if the creature were praying. But the instant a fly or other insect draws near, the big front legs shoot out and seize it, and down the throat of the mantis it goes. We must regard it as a friend of man, for it kills and eats a great number of injurious insects. There is one species of mantis in India which is most wonderfully colored, so that when it rests it looks like some gay orchid. Insects approach it believing it to be a pretty flower, and are at once seized and gobbled up. Scientists are trying to introduce the European mantis to this country, as it lives farther north than our native species.

Going to the opposite extreme we come upon the up-curving body of a very fierce-looking beetle. We point a stick or a finger at him, and he opens his strong jaws and curls up the back part of his body, and looks ready to fight. And so he is. He is the big rove beetle, which is called the devil's coach-horse. For all his black, ugly body, his threatening looks, and the nasty fluid which he emits when attacked, he is a favorite with English gardeners who study natural history.

HOW THE DEVIL'S COACH-HORSE SLAYS A CATERPILLAR

His appetite is as big as his courage. The devil's coach-horse will attack any insect, no matter how big. With a snap of its great jaws it will cut caterpillars or earwigs in half, and make a meal of them. Snails and slugs are among its dainties, and it will eat any carrion which it may find. The devil's coach-horse belongs to a big family of rove beetles, of which we have many in this country, most of them helpful either as insect eaters or as scavengers. One of the family is to be found among the pets in the ants' nests of which we have read. They keep it because it gives them honey.

We have read so much about eggs deposited in the bodies of live creatures that we may turn now to beetles which choose dead bodies for the purpose. These are the famous burying beetles. They are to be seen in England, and it was the study of those there that led to the discovery of many interesting forms in America and other countries. We never see them unless there happens to be a mole or mouse or some other small animal lying dead in the garden. Then they come up as if from nowhere, husband and wife, busy as can be, and claim the body as if they had bought and paid for it. Folding up their wings, they at once begin to dig.

If the soil on the spot is not of the right sort for their work, they drag the dead animal to some place more suitable. To do this requires extraordinary strength in beetles, but they have very powerful jaws. The digging begins with a circular furrow like that made by the ant-lion, and then another is made within that. They keep digging away until the body begins to sink. When it has sunk far enough they throw over it the earth which they have excavated. Then they feast upon the body, and the female lays her eggs in it, so that when the larvæ hatch they shall find food ready to hand. Then off they go again.

These are not the only beetles to bury things. The sacred beetle of Egypt does it, too. This beetle, whose proper name is the scarabæus, belongs to a numerous family. It collects refuse, makes it into a ball, and rolls it into its hole in the ground. There it feeds

untiringly, for a fortnight at a time, without resting, until the mass is gone. In other balls of refuse it deposits its egg, and from this, in due course, the young scarab issues. The Egyptians used to think that the old scarab died on entering the ground, and that the young scarab was the same beetle resurrected. Many other silly traditions of this sort came to be associated with this beetle, and it was as sacred to the Egyptians as the ibis. They worshipped it while it was alive, and after its death embalmed it, just as they embalmed their own monarchs. And yet it is only a scavengering beetle of very unpleasant tastes.

These curious beetles are rolling a ball of refuse to their hole. When they have it there they feed on it ravenously, hardly stopping to rest. They are called scarabs, and were once worshipped by the Egyptians.

A BEETLE'S LONG JOURNEY TO SAVE OUR FORESTS FROM THE GIPSY MOTH

A few years ago, it was learned that a scarab beetle in Europe, which eats voraciously, lives largely on the gipsy moth. This moth and the brown-tail moth were doing so much damage to the trees in Massachusetts, and were spreading so rapidly, that special efforts were made by the government to bring some of the beetles to this country. This was a very difficult matter, because they had to be caught and sent alive while the caterpillars of the gipsy moths were on the trees, and it is difficult to send lively, crawling beetles on their travels. However, it was at last found that a good traveling coach could be made for them out of match-boxes. These were filled with damp sphagnum moss, which will keep damp for a long time. One beetle and a fat caterpillar were put in each match-box, several match-boxes were packed in a larger wooden box, and in this the beetles traveled luxuriously by mail. In Washington they were fed and cared for by trained entomologists, and when enough had been collected, and their ways of life carefully studied, they were set free in Massachusetts to begin their long, slow war against the caterpillars.

The beetle, which is a beautiful green insect, about an inch long, lays its eggs in the ground. When the larvæ hatch out they climb the trees, and feed not only on the caterpillars but also on the pupæ and even on the moths. As soon as they are fully grown, the beetle larvæ burrow into the ground and turn into pupæ. When they have transformed themselves into beetles, they come out again, climb the trees and eat more caterpillars, until it is time to pack themselves away into their winter burrows to sleep.

Here we see a pair of burying beetles busy at work on a dead mouse. They will dig round the body until it sinks into the ground and then eat part of it, and the female will lay her eggs in the remains of the carcase.

Returning to our garden again we must say a word for another beetle. Nearly every one that we find there is a friend, living upon injurious grubs and insects. The tiger beetle deserves special mention as among helps of the gardener. There are about a thousand species of this beetle, but the majority of them are in the hot lands. Ours are pretty and active, and possess great jaws and powerful wings. They live entirely on insects. The list of friendly insects is far from complete. There are, indeed, thousands and thousands of different sorts of insects that are harmful to us, and there are probably just as many that help us. We can all extend our knowledge by personally watching the daily lives of the insects around us in our gardens and elsewhere.

THE NEXT STORY OF NATURE IS ON PAGE 3355.

A GREAT STATUE OF A GREAT GENERAL

In other parts of our book you may read of General William Tecumseh Sherman. This statue, modeled by Augustus St. Gaudens, our most famous American sculptor, has been erected in his honor. It stands in the Plaza, which is one of the entrances to Central Park, in New York City, and represents General Sherman as he appeared on the March to the Sea. The female figure, carrying the palm before him, represents Fame or Victory. This is considered to be one of the finest statues in the United States.

THE NOVELS OF THACKERAY

MOST of the famous novels written by W. M. Thackeray, whose life is told on page 2325, introduce us to characters whom we seldom grow to like so well as we do those of his great contemporary Charles Dickens. Of course, there are exceptions to these among his stories, for he was a gentle-hearted, lovable man himself, and could scarcely have failed to give us some lovable characters. The first of his novels chosen for reading here is, in many respects, his best; perhaps it is not too much to say that "The History of Henry Esmond" is the finest historical novel ever written. It is the most charming of all his works, Henry Esmond and Lady Castlewood being two of the noblest characters he ever created. The story was first published in 1852, and a sequel to it appeared six years later, entitled "The Virginians," the story of which we shall read after that of "Henry Esmond."

HENRY ESMOND

A ROMANCE OF THE DAYS OF QUEEN ANNE

CONTINUED FROM 2979

IN the latter days of William III. and during the reign of Queen Anne, when many people in England were darkly scheming to restore the crown of that country to the son of James II., the events of this story are supposed to have taken place. Concerning the birth of Henry Esmond, it is necessary to know something at the outset, as much of importance later depends upon that. There was a certain Thomas Esmond, who had been to the Low Countries in the train of the Duke of York during the wars, and there he had married a weaver's daughter. They had one son, named Henry. Thomas Esmond, soon deserting his wife, returned to England, and the unhappy woman entered a convent, and there she died.

Succeeding to the title and estates of his uncle the Viscount Castlewood, Thomas Esmond married his cousin Isabel and kept his earlier marriage a secret. Although he was in many respects a rascal, the new viscount was not without some touches of goodness. On hearing of his first wife's death he had his little son Henry brought over to his fine ancestral home of Castlewood and placed in the care of his chaplain, Father Holt.

This was done, however, without his acknowledging the fact that little Henry was his rightful heir, or even admitting that he was his son. Indeed, the little fellow, as he grew up and gradually began to understand what others thought of him, gathered that he was supposed to be called Esmond by courtesy and not by right.

The Esmonds, though not all Roman Catholics, had, as a family, been loyal to the Stuart kings; and Father Holt, who was Henry's tutor, was a very active spirit in the Jacobite plots to restore James II. to his throne. Castlewood was, indeed, a centre of political intrigue. The Esmonds had made many honorable sacrifices in their devotion to the Stuarts; and, when James II. made his historic effort against William III. at the Battle of the Boyne, Thomas Esmond fell fighting for the defeated king. His widow Isabel had been as strong a Jacobite as her husband, and, fleeing from the mansion of Castlewood, secluded herself in her house at Chelsea. Father Holt had also to take himself off. Little Henry was thus left alone with the servants at Castlewood, wondering what it all meant and feeling very lonely.

Soon, however, the new Viscount Castlewood, Colonel Frank Esmond, a bluff and hearty man of forty-five or fifty, came to take possession of the house and estates he had inherited from his deceased kinsman. With him came his wife, who was but

twenty years of age, and their little daughter Beatrix, a lovely child of four, who kissed her cousin Henry the moment they met, though she had never seen him before. There was also a baby-boy, carried in his nurse's arms. These were the four new friends with whom the life of Henry was now to be entwined.

When the young Lady Castlewood asked him his name he said, "My name is Henry Esmond," and looked up at her in a sort of delight and wonder, for she appeared to him the most charming object he had ever looked on.

HENRY SEES A VISION OF BEAUTY AND BEGINS A HAPPIER NEW LIFE

Her beautiful golden hair was shining in the gold of the sun; her complexion was dazzling; her lips smiling, and her eyes beaming with a kindness that made Henry's heart beat with surprise. Her beauty, both of body and mind, was to be a guiding star to him through life; and little he guessed how dear they would become to each other, for although a lady of twenty is quite an elderly person to a boy of twelve, a time soon comes when the eight years of difference count for nothing.

Lady Castlewood was a devoted wife, but her lord was not the best behaved of husbands. She served and tried to please him in every way, she watched over her children with loving care, and treated Henry with a gentleness he had never known before. A new and happy life was opening out for him, when, by a strange fate, he became the innocent cause of much unhappiness to his beautiful cousin.

On a visit to the village he had somehow caught the infection of smallpox, and when this was discovered at Castlewood, Lord Castlewood made it an excuse for going to town with Beatrix.

HOW HENRY WAS THE INNOCENT CAUSE OF LADY CASTLEWOOD'S UNHAPPINESS

Lady Castlewood and little Frank, who stayed at home, also caught the disease; and when Lady Castlewood recovered she had lost some of the delicate beauty which had first charmed the eye of her husband. When the viscount returned he did not disguise his disappointment at the change which the disease had made in his wife, and she never forgave the look he then gave her.

In due course Henry was sent to Cambridge University to study for the priesthood, and when he returned for his first vacation he found as a guest at Castlewood and a boon companion of the viscount a certain Lord Mohun, whose evil reputation was known throughout the country. Lady Castlewood was now clearly unhappy in her husband's conduct, while he, whose drinking habits were evidently growing, complained to Henry of how she treated him, saying, "It's been that way ever since you brought the smallpox into the house."

Her ladyship naturally disapproved of her husband's friendship with the notorious Mohun; and when Henry returned from Cambridge a second time he found the Castlewoods openly unfriendly with each other, and Mohun again a guest. Castlewood seemed to grow more reckless in his conduct, and one night before his wife he went so far as to say to Miss Beatrix: "When thou art old enough, Trix, thou shalt marry Mohun!" At this Beatrix laughed, and said Mohun had had a long talk with her mamma the night before.

"Ask Lord Mohun what I said to him, Frank," said Lady Castlewood, with great dignity, and taking her daughter by the hand, she swept out of the room.

A QUARREL BETWEEN TWO NOBLEMEN AND WHAT IT LED TO

"I will tell you what your wife said to me," said Mohun. "She asked me not to drink and gamble with you any more. You know best whether that was for your good or not."

"Oh, of course!" sneered Castlewood. "You are a model man, my lord."

"I am no saint, though your wife is," retorted Mohun. "And I can answer for my actions as others must for their words."

"When you please, my lord," said the viscount.

These words betokened the prospect of a duel, and Lady Castlewood was in great fear that such might be the case. But Mohun left the house next day, apparently on good terms with Castlewood. Soon an uneasy sense of trouble was felt by all at Castlewood, as the viscount grew moody and silent and had much business with his lawyer.

In about a month he declared that he was ill, and required to see his doctor in London. Henry was asked to accompany him; and at a tavern in the city Lord Castlewood met Mohun and others,

and engaged in a game of cards, in the course of which Mohun and Castlewood quarreled. Henry could see that the whole thing had been arranged, and, as the party proceeded to Leicester Fields to fight a duel, Castlewood confessed to Henry that such was the truth. Mohun, he said, had written an insulting letter to Lady Castlewood, which he had intercepted, and he would have challenged Mohun earlier only that he had first to pay the betting debts he owed him.

Almost before Henry had quite realized what was happening, the duel was over, the misled but good-hearted viscount mortally wounded. It was a momentous event for him, for just before the viscount died, he handed him a document which disclosed the truth about his birth, and proved him to be the real heir of Castlewood. The secret had been told to the viscount by the mysterious Father Holt.

What was Henry to do with this proof of his fortune? To claim the title and estates meant to dispossess young Frank, and to add to the already heavy sorrows of his beloved friend. He threw the paper in the fire!

HENRY ESMOND MAKES A GREAT SACRIFICE AND IS ILL-REPAID

This great act of self-sacrifice seemed to be badly rewarded when Lady Castlewood visited him in prison, where he was lodged for a time for his part in the duel. She reproached him bitterly for not preventing her husband's death. Distracted with grief, she was unwittingly cruel in what she said to him, and she left his presence declaring she never wished to see him more.

On being released, Henry had now to give up all thoughts of becoming a priest. But as the Lady Isabel offered to help him, he did not hesitate to accept her help, knowing how much more was within his right. Thanks to her, he secured a commission in the army, and for more than a year he saw much active service, winning the rank of captain. On his return to England he was greatly disturbed to hear that Lady Castlewood was expected to marry the Rev. Tom Tusher, a characterless creature, who was chaplain at Castlewood. This he determined to prevent at all costs, ignoring the fact that she had asked him never to see her again. So he posted off to Winchester, where she was staying; and there, in the solemn old cathedral, still in her widow's dress, he found her at evensong, and by her side her son Frank, now grown into a handsome youth. As the service finished, Frank saw him first, and rushed to Captain Esmond with an eager welcome; while Lady Castlewood said:

"It was kind of you to come back to us, Henry. I thought you might come."

LADY CASTLEWOOD AND HENRY ESMOND BECOME GOOD FRIENDS AGAIN

She gave him her hand—her little fair hand. There was only her marriage-ring on it. The quarrel was all over. It was just as though they had never parted. And, best of all, there was not a word of truth in the story about her engagement to Tom Tusher, which had been told to Esmond by the spiteful old gossip, Lady Isabel.

As they walked homeward in the gathering dusk of the winter's day, Lady Castlewood told Henry of her joy in having him back again. And he, in his new happiness, proposed that they should never part.

"Come away," he said. "Leave this Europe, which has so many sad recollections for you, and begin life again with me in the New World. There is that land in Virginia which King Charles gave our ancestor. Frank will give us that."

"Hush, boy," she replied. "For you the world is just beginning; for me, I must leave it and pray out my expiation, dear. But when your heart is wounded come to me, Henry."

When they reached the house, a new sensation was in store for Esmond.

HOW THE BEAUTY OF BEATRIX BEWITCHED HER COUSIN HARRY

Down the wide stairs of the old hall came the lovely figure of a bewitching young woman, carrying a candle in her hand, which lighted up the prettiest white neck in the world, and shone upon the scarlet ribbon she had donned on hearing that Captain Esmond was coming to dinner. This was Beatrix, whom he had left a girl and found a woman.

All the roses of spring could not vie with the brightness of her complexion. Esmond thought he had never seen anything like the sunny lustre of her eyes. She was a brown beauty—that is, her eyes, hair, and eyebrows and eyelashes

were dark, her hair curling with rich undulations and waving over her shoulders ; but her complexion was as dazzling white as snow in sunshine. She approached, smiling upon Esmond, who could look at nothing but her eyes. She advanced, holding forward her head, as if she would have him kiss her as he used to do when she was a child.

WHY CAPTAIN ESMOND WENT OFF AGAIN TO THE WARS IN GERMANY

"Stop!" she said. "I am grown too big! Welcome, Cousin Harry!" And after making him a sweeping curtsey, she gave him both her hands and said: "Oh, Harry, we are so glad you are come!"

With many a tale of how the bewitching Trix had certain of the great noblemen of the day at her feet, Frank, in his boyish way, entertained Esmond during his stay. If Esmond did not as yet realize that Beatrix was, with all her gentler charms, not a little vain and somewhat fickle-hearted, he could see that whoever was to marry her would have to possess both rank and wealth. Yet deeply though he loved and admired Lady Castlewood, who was just as much older than he as Trix was younger, he was not without thoughts of asserting his claim to the Castlewood title and estates when he found himself bewitched by Beatrix ; so to escape from his conflicting emotions, he went off again to the wars in Germany.

On his return to England he found himself possessed of the small fortune and the valuable diamonds of the Lady Isabel, who had died in his absence. Beatrix he considered more beautiful than ever. She was now engaged to marry the Duke of Hamilton.

THE AMBITIONS OF MISTRESS BEATRIX AND A JACOBITE PLOT

That eminent nobleman was about to proceed to France with the hope of inducing the son of James II., known as the Pretender, to come to England and make an effort to regain the throne, as Queen Anne was then in failing health. Beatrix was deeply involved in the plot, and was radiantly happy as she thought of her future greatness.

"Go and marry mamma," she said to Esmond, who had now attained the rank of colonel. "Go and be Darby and Joan for the rest of your lives! That's what you two are fitted for! Oh, cousin, when will you learn that I have no heart?"

At a modest house in Kensington, near by the palace, Esmond found his dear Lady Castlewood, and there learned from her that she, too, had come into possession of the secret of his birth, revealed to her by the Lady Isabel just before she died. It had been considered better for the cause of the exiled king that the secret should have been kept while Henry's father was alive. "But now the decision is with you, Harry," she said.

"My decision was made beside the death-bed of my dear lord," said Colonel Esmond. "I am the head of the family, but your son is Viscount Castlewood, still."

"Dear, generous Harry!" cried the lady, throwing herself at his feet. "Nay, do not raise me. Let me kneel and—and worship you."

The generosity of Esmond—to which he was prompted more by love for Lady Castlewood than out of consideration for her son, though he had ever loved the manly Frank as a younger brother—made happy his dear lady.

BEATRIX SUFFERS A GREAT LOSS AND ESMOND ENGAGES IN A NEW PLOT

But the tragic death of the Duke of Hamilton, who fell, like the late viscount, in a duel with Mohun, though not before fatally wounding the rascal, was a sad blow for Beatrix. She bore herself with great dignity in the face of her ruined hopes, and proved thereby, perhaps, the truth of what she had said to Esmond about her lack of heart.

Colonel Esmond himself now put in action a plan for bringing the Pretender, James Stuart, over to England, so that on the death of Queen Anne he might quietly be proclaimed as king. The young Viscount Castlewood, who had been serving with the army on the Rhine, was still in that district. In personal appearance he closely resembled the Pretender ; and nothing was easier than that the son of James II. should travel disguised as Viscount Castlewood, while Frank accompanied him as his servant. So was it planned and carried out. The Pretender was brought to the modest house in Kensington, where the Esmonds and all the Jacobite leaders in the secret did homage to him as their rightful king.

MISTRESS BEATRIX KNIGHTING HENRY ESMOND

Esmond had been of service to young Lord Castlewood, and returning to England while his kinsman remained abroad, Esmond found the ladies of the family overjoyed to have him. A reception was prepared for him ; and Beatrix, in the presence of her mother and Lady Isabel, knighted him as in the olden days.

This picture is reproduced from the painting by A. L. Egg, R.A., now hanging in the National Gallery of British Art.

All were now filled with the greatest hopes for the success of their conspiracy, and the only one among them who did not seem to be in earnest was the effeminate and pleasure-loving James Stuart himself. He was more eager to make love to Beatrix than to engage with his supporters in advancing their scheme.

So Beatrix was practically banished to Castlewood, and felt very bitter towards Esmond in consequence, blaming him chiefly for what she considered the indignity put upon her.

At almost any moment, the conspirators hoped, the great hour might arrive when a new King James would be proclaimed by them, as the announcement of the queen's death was made. One day, when the queen was thought to be sinking rapidly, they discovered, to their amazement, that the Pretender had disappeared from the house in Kensington. At once they guessed that he had made his way to Castlewood, there to enjoy the company of the bewitching Trix.

Hastily getting to horse, Colonel Esmond and the young viscount spurred thither at breathless pace, and found they had guessed aright. Forcing themselves, no longer ceremoniously, into the presence of the young prince, Esmond upbraided him for his folly and the neglect of a great opportunity, saying that even now, it might be, the queen had died, and here was he writing foolish verses to a beautiful but light-headed girl. James Stuart treated the colonel at first with haughtiness, but Esmond was determined to brook no opposition in the course he had now decided upon ; and he asked the Pretender to accompany him into the chaplain's room, where, from a little secret chamber over the mantelpiece, the colonel took some papers which had long been there concealed.

" Here, may it please your Majesty," said Colonel Esmond, " is the patent of marquis sent over by your Royal father at St. Germains to Viscount Castlewood, my father ; here is the certificate

of my father's marriage to my mother, and of my birth and christening. I was christened of that religion of which your sainted sire gave all through life so shining an example. These are my titles, dear Frank"—turning to the astonished young viscount—"and this is what I do with them: here go baptism and marriage, and here the marquisate and the august sign-manual in which the late King James was pleased to honor our race."

COLONEL ESMOND BREAKS HIS SWORD BEFORE THE PRETENDER

So saying, Esmond set the papers burning in the brazier, and continued addressing the young prince.

"You will please, sir, to remember that our family hath ruined itself by fidelity to yours, that my grandfather spent his estate and gave his blood and his son to die in your service; that my dear lord's grandfather—for lord you are now, Frank, by right and title too—died for the same cause; and that my poor kinswoman, my father's second wife, sent all her wealth to the king, getting in return that precious title that lies in ashes and this inestimable yard of blue ribbon. I lay this at your feet and stamp upon it; I draw this sword and break it and deny you; and Frank will do the same, won't you, cousin?"

Frank, who had been looking with a dazed air at the papers as they flamed in the old brazier, took out his sword and broke it, saying:

"I go with my cousin," giving Esmond his hand. "It's all your Majesty's own fault. The queen is dead most likely by this time, and you might have been king if you had not deserted your loyal friends in London."

HOW ANOTHER DUEL WAS INTERRUPTED BY MISTRESS BEATRIX

"Thus to lose a crown," said the young prince, starting up and speaking in his eager way, "and the loyalty of such hearts as these! I offer you the only reparation in my power. Will you favor me by crossing swords with me?"

James Stuart and Esmond had no sooner crossed swords than Frank stepped forward, and with the broken blade of his own knocked them up, just as Beatrix entered the room. A great change had come over her; her face had now assumed a look of deepest care, her cheeks were pale, her eyes glared.

"Will it please the king to breakfast before he goes?" was all she said; but, going up to Esmond, she hissed low a few words of bitterness in his ear. And, looking at her now, he wondered that he had ever thought of love for her.

When the prince had reached London again, whither he was accompanied by Esmond and Castlewood, there was a great crowd outside Kensington Palace, and presently from the gates trumpeters and heralds came forth. The trumpets blew and the heralds proclaimed: "George, by the Grace of God, of Great Britain, France, and Ireland, King, Defender of the Faith." And the people shouted "God save the king!"

Thus King George's trumpeters blew all the hopes of the Pretender to the winds, and that unworthy prince was soon hurried back in secret to France.

After the failure of the Jacobite plot the young Viscount Castlewood went abroad, and there he married, somewhat foolishly, a German woman. When, soon after, Beatrix left her mother and her home to stay in France, Esmond one day found Lady Castlewood in tears, and besought that dear lady to confide herself to the care and devotion of one who would never forsake her.

COLONEL ESMOND AND LADY CASTLEWOOD BEGIN A NEW LIFE IN VIRGINIA

So it came about that this true hero and this gentlest of women joined hands as husband and wife. Frank gave them the American property of the family in Virginia, and thither they went to found a new Castlewood.

"In our trans-Atlantic country," to quote the words of Esmond himself, "we have a season, the calmest and most delightful of the year, which we call the Indian summer; I often say the autumn of our life resembles that happy and serene weather, and am thankful for its rest and sweet sunshine. Heaven hath blessed us with a child, which each parent loves for her resemblance to the other. Our diamonds are turned into ploughs and axes for our plantations, and into negroes, the happiest and merriest, I think, in all this country; and the only jewel by which my wife sets any store, and from which she hath never parted, is that gold button she took from my arm on the day when she visited me in prison."

THE NEXT FAMOUS BOOKS ARE ON PAGE 3419.

A BALLAD BY A GREAT AMERICAN POET

JOHN GREENLEAF WHITTIER, one of the foremost poets of America, was born on December 17, 1807, and died September 7, 1892. He took a prominent part in the long fight for the liberation of the slaves in our land, and all his writings breathe a steady devotion to the cause of liberty and righteousness. One of his ballads has been chosen here as an example of his sweet and tender poetry. It is a simple story of what is happening every day, and there are many to whom the words "It might have been" have all the sad meaning they had for Maud Müller and the Judge.

MAUD MÜLLER: A TALE IN VERSE

CONTINUED FROM 3178

MAUD MÜLLER, on a summer's day,
Raked the meadow sweet with hay.

Beneath her torn hat glowed the wealth
Of simple beauty and rustic health.

Singing, she wrought, and her merry glee
The mock-bird echoed from his tree.

But when she glanced to the far-off town,
White from its hill-slope looking down,

The sweet song died, and a vague unrest
And a nameless longing filled her breast—

A wish, that she hardly dared to own,
For something better than she had known.

The Judge rode slowly down the lane,
Smoothing his horse's chestnut mane.

He drew his bridle in the shade
Of the apple-trees, to greet the maid,

And asked a draught from the spring that flowed
Through the meadows across the road.

She stooped where the cool spring bubbled up,
And filled for him her small tin cup,

And blushed as she gave it, looking down
On her feet so bare, and her tattered gown.

"Thanks!" said the Judge, "a sweeter draught
From a fairer hand was never quaffed."

He spoke of the grass, and flowers and trees,
Of the singing birds and the humming bees;

Then talked of the haying, and wondered whether
The cloud in the west would bring foul weather.

And Maud forgot her briar-torn gown,
Her graceful ankles bare and brown,

And listened, while a pleased surprise
Looked from her long-lashed hazel eyes.

At last, like one who for delay
Seeks a vain excuse, he rode away.

Maud Müller looked and sighed, "Ah, me!
That I the Judge's bride might be!

"He would dress me up in silks so fine,
And praise and toast me at his wine.

"My father should wear a broadcloth coat,
My brother should sail a painted boat.

"I'd dress my mother so grand and gay,
And the baby should have a new toy each day.

"And I'd feed the hungry, and clothe the poor,
And all should bless me who left our door."

The Judge looked back as he climbed the hill,
And saw Maud Müller standing still.

"A form more fair, a face more sweet,
Ne'er hath it been my lot to meet.

"And her modest answer and graceful air
Show her wise and good as she is fair.

"Would she were mine, and I to-day,
Like her, a harvester of hay:

"No doubtful balance of rights and wrongs
And weary lawyers with endless tongues.

"But low of cattle and song of birds,
And health of quiet and loving words."

But he thought of his sisters, proud and cold,
And his mother, vain of her rank and gold.

So closing his heart, the Judge rode on,
And Maud was left in the field alone.

But the lawyers smiled that afternoon,
When he hummed in court an old love tune;

And the young girl mused beside the well,
Till the rain on the unraked clover fell.

He wedded a wife of richest dower,
Who lived for fashion as he for power.

Yet oft in his marble hearth's bright glow
He watched a picture come and go.

And sweet Maud Müller's hazel eyes
Looked out in their innocent surprise.

Oft when the wine in his glass was red,
He longed for the wayside well instead;

And closed his eyes on his garnished rooms,
To dream of meadows and clover blooms.

And the proud man sighed with a secret pain
"Ah, that I were free again!

"Free as when I rode that day,
Where the barefoot maiden raked her hay."

She wedded a man unlearned and poor,
And many children played round her door.

But care and sorrow and child-birth pain
Left their traces on heart and brain,

And oft when the summer sun shone hot
On the new-mown hay in the meadow lot.

And she heard the little spring-brook fall
Over the roadside, through the wall,

In the shade of the apple-tree again
She saw a rider draw his rein ;

And, gazing down with timid grace,
She felt his pleased eyes read her face.

Sometimes her narrow kitchen walls
Stretched away into stately halls.

The weary wheel to a spinet turned,
The tallow candle an astral burned,

And for him who sat by the chimney lug,
Dozing and grumbling o'er pipe and mug,

A manly form at her side she saw,
And joy was duty, and love was law ;

Then she took up her burden of life again,
Saying only, " It might have been ! "

Alas ! for maiden, alas ! for Judge,
For rich repiner and household drudge !

God pity them both, and pity us all,
Who vainly the dreams of youth recall,

For of all sad words of tongue or pen,
The saddest are these : " It might have been ! "

Ah, well ! for us some sweet hope lies
Deeply buried from human eyes ;

And, in the hereafter, angels may
Roll the stone from its grave away !

A LAUGHING SONG

We have already had the pleasure of reading several of William Blake's Nature songs in our "Book of Poetry." Many of his short poems, such as that given here, might be described as songs of " the joy of the earth," borrowing a phrase from another poet. The idea of Nature being glad is, of course, as ancient as thought ; and we find such phrases in the Bible as "Let the hills be joyful" and "The trees of the field shall clap their hands."

WHEN the green woods laugh with the voice of joy,
And the dimpling stream runs laughing by ;
When the air does laugh with our merry wit,
And the green hill laughs with the noise of it ;

When the meadows laugh with lively green,
And the grasshopper laughs in the merry scene ;
When Mary, and Susan, and Emily,
With their sweet round mouths sing, " Ha, ha, he ! "

When the painted birds laugh in the shade,
Where our table with cherries and nuts is spread :
Come live, and be merry, and join with me
To sing the sweet chorus of " Ha, ha, he ! "

POOR DOG TRAY

This has long been a favorite poem. Its simple pathos and just sentiment give it enduring life. It was written by Thomas Campbell, many of whose poems have appeared in these pages, and is properly entitled "The Harper," but it is more familiar under the title we have given it here.

ON the green banks of Shannon, when Sheelah was nigh,
No blithe Irish lad was so happy as I ;
No harp like my own could so cheerily play,
And wherever I went was my poor dog Tray.

When at last I was forced from my Sheelah to part, [heart) :
She said (while the sorrow was big at her
" Oh ! remember your Sheelah when far, far away, [Tray."
And be kind, my dear Pat, to our poor dog

Poor dog ! he was faithful and kind to be sure,
And he constantly loved me although I was poor ;
When the sour-looking folk sent me heartless away,
I had always a friend in my poor dog Tray.

When the road was so dark, and the night was so cold,
And Pat and his dog were grown weary and old,
How snugly we slept in my old coat of grey,
And he lick'd me for kindness—my old dog Tray.

Though my wallet was scant I remember'd his case,
Nor refused my last crust to his pitiful face ;
But he died at my feet on a cold winter day,
And I play'd a sad lament for my poor dog Tray.

Where now shall I go, poor, forsaken, and blind ?
Can I find one to guide me, so faithful and kind ?
To my sweet native village, so far, far away.
I can never more return with my poor dog Tray.

THE PRIEST AND THE MULBERRY TREE

Thomas Love Peacock, born October 18, 1785, and died January 23, 1866, wrote a number of remarkable stories, full of wit and satire, and sprinkled with many charming poems. His novels are little read to-day, and only here and there do we find his poems quoted. The following is from his pen, and although the lesson it conveys is one that is very obvious, it is presented with a real touch of sly humor.

DID you hear of the curate who mounted his mare,
And merrily trotted along to the fair ?
Of creature more tractable none ever heard :
In the height of her speed she would stop at a word ; [Hey !
But again with a word, when the curate said
She put forth her mettle and gallop'd away.

As near to the gates of the city he rode,
While the sun of September all brilliantly glow'd,
The good priest discover'd, with eyes of desire,
A mulberry-tree in a hedge of wild briar :
On boughs long and lofty, in many a green shoot, [fruit.
Hung large, black, and glossy, the beautiful

The curate was hungry and thirsty to boot ;
He shrunk from the thorns, though he long'd for the fruit ;
With a word he arrested his courser's keen speed,
And he stood up erect on the back of his steed ;
On the saddle he stood while the creature stood still, [fill.
And he gather'd the fruit till he took his good

" Sure never," he thought, " was a creature so rare,
So docile, so true, as my excellent mare ;
Lo, here now I stand," and he gazed all around,
" As safe and as steady as if on the ground ;
Yet how had it been, if some traveller this way,
Had, dreaming no mischief, but chanced to cry Hey ? "

He stood with his head in the mulberry-tree,
And he spoke out aloud in his fond reverie ;
At the sound of the word the good mare made a push
And down went the priest in the wild-briar bush.
He remembered too late, on his thorny green bed, [be said.
Much may well may be thought cannot wisely

LITTLE VERSES FOR VERY LITTLE PEOPLE

A LITTLE old man and I fell out;
How shall we bring this matter about?
Bring it about as well as you can;
Get you gone, you little old man.

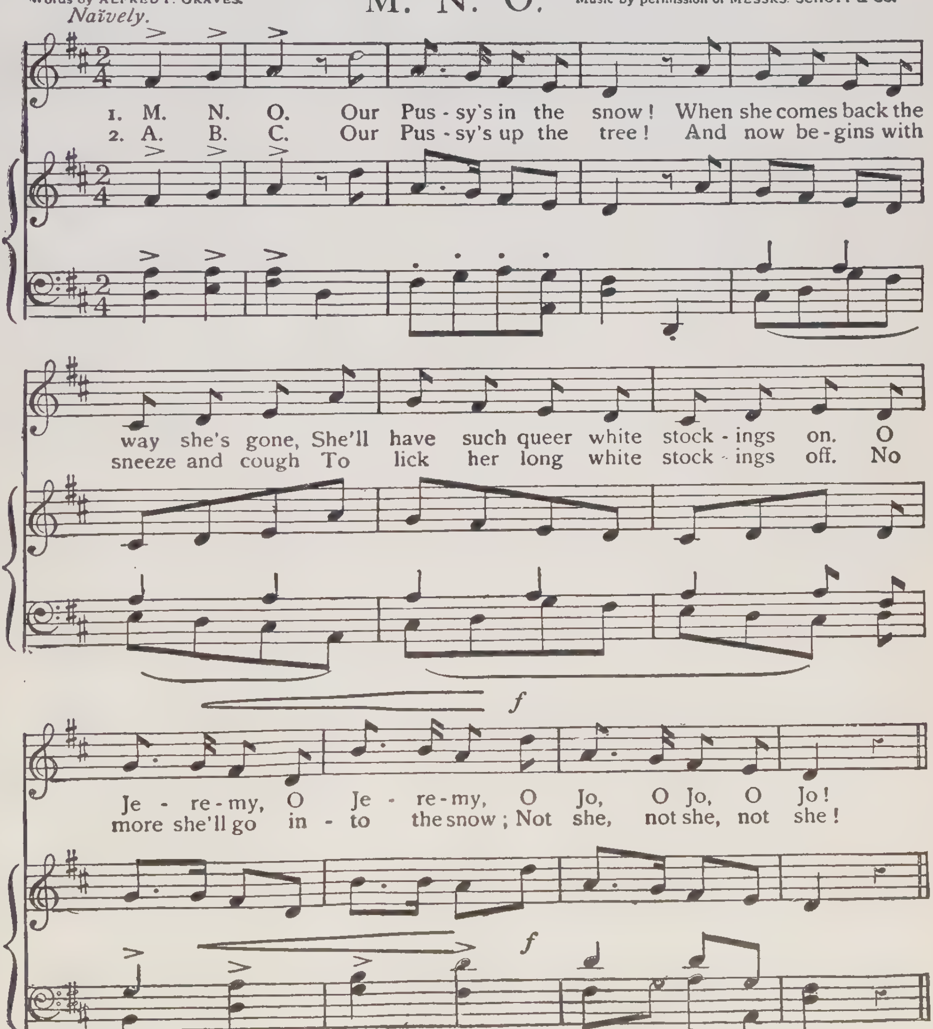
THERE'S a neat little clock,
In the schoolroom it stands,
And it points to the time
With its two little hands.
And may we, like the clock,
Keep a face clean and bright,
With hands ever ready
To do what is right.

AS I was going up Pippen Hill,
Pippen Hill was dirty;
There I met a pretty miss,
And she dropped me a curtsey.

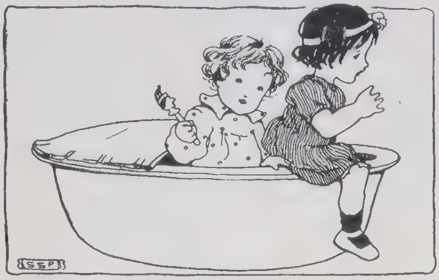
Little miss, pretty miss,
Blessings light upon you!
If I had half a crown a day,
I'd spend it all upon you.

THEY that wash on Friday, wash in need;
And they that wash on Saturday, oh! they're sluts indeed.

Words by ALFRED P. GRAVES. **M. N. O.** Music by permission of MESSRS. SCHOTT & Co.



BLESS you, bless you, bonnie bee!
  Say, when will my wedding be?
If it be to-morrow day,
Take your wings and fly away.
Fly away east, or fly away west,
And show me where *he* lives who loves
  me the best!



BABY and I
  Were baked in a pie,
The gravy was wonderful hot!
We had nothing to pay
To the baker that day,
And so we crept out of the pot.

"HOW many miles to Babylon?"
  "Three score miles and ten."
"Can I get there by candle-light?"
  "Yes, and back again;
If your heels are nimble and light
You may get there by candle-light."

BRIAN O'LIN had no breeches to
  wear,
So he bought him a sheepskin and
  made him a pair,
With the skinny side out, and the
  woolly side in,
"Ah, ha, that is warm!" said Brian
  O'Lin.

Brian O'Lin and his wife and wife's
  mother,
They all went over a bridge together;
The bridge was broken and they all
  fell in,
"Mischief take all!" quoth Brian
  O'Lin.

UP hill and down dale;
  Butter is made in every vale;
And if that Nancy Cook
Is a very good girl,
She shall have a spouse,
And make butter anon,
Before her old grandmother
Grows a young man.

WASH me and comb me,
  And lay me down softly,
And lay me on a bank to dry,
That I may look pretty,
When somebody comes by.

"OLD woman, old woman, shall we
  go a-shearing?"
"Speak a little louder, sir, I'm very
  thick of hearing."
"Old woman, old woman, shall I kiss
  you dearly?"
"Thank you, kind sir, I hear you very
  clearly."

"LITTLE maid, pretty maid, whither
  goest thou?"
"Down in the forest to milk my cow."
"Shall I go with thee?" "No, not
  now;
When I send for thee, then come
  thou."

SLEEP, baby, sleep,
  Our cottage vale is deep;
The little lamb is on the green,
With woolly fleece so soft and clean—
  Sleep, baby, sleep!

Sleep, baby, sleep,
Down where the woodbines creep;
Be always like the lamb so mild,
A kind, and sweet, and gentle child—
  Sleep, baby, sleep!

DRIBBLE, dribble, trickle, trickle,
  What a lot of rawdust!
My dolly's had an accident,
  And has lost a lot of sawdust!

THE cuckoo's a bonny bird,
  She sings as she flies;
She brings us good tidings,
  And tells us no lies.
She sucks little birds' eggs,
  To make her voice clear,
And never cries Cuckoo
  Till spring-time of the year.

RHYMES AND JINGLES OF MARY MAPES DODGE

We have already read in the BOOK OF POETRY several poems specially written for young folk by the late Mary Mapes Dodge, who used to edit the famous children's magazine St. Nicholas. On this page we have gathered together a collection of her little verses, which are rather nursery rhymes than poems. They have been reprinted, by permission of Messrs. Charles Scribner's Sons, from Miss Dodge's book entitled Rhymes and Jingles.

BILLY BOY

POOR Billy boy was music mad,
On music mad was he;
And yet he was as blithe a lad
As any lad could be.
With a "hi-de-diddle,
Bow and fiddle,
Rig-a-my, ho!" sang he—
For Billy was as blithe a lad
As any lad could be.

"Nobody knows the joys I know,
Or sees the sights I see;
So play me high, or play me low,
My fiddle's enough for me.
It takes me here, it takes me there—
So play me low or high—
It finds me, binds me anywhere,
And lifts me to the sky."
With a "hi-de-diddle,
Bow and fiddle,
Rig-a-my, ho!" sang he—
For Billy was as blithe a lad
As any lad could be.

THE GOOD LITTLE GIRLS

OH, where are all the good little girls?
Where are they all to-day?
And where are all the good little boys?
Tell me, somebody, pray.

Safe in their father's and mother's hearts,
The girls are stowed away;
And where the girls are, look for the boys—
Or so I've heard folk say.

LITTLE WHITE FEATHERS

LITTLE white feathers,
Filling the air—
Little white feathers,
How came ye there?
"We came from the cloud-birds
Sailing so high;
They're shaking their white wings
Up in the sky."

Little white feathers,
How swift you go!
Little white snowflakes,
I love you so!
"We are swift because
We have work to do;
But hold up your face,
And we'll kiss you true."

ONE AND ONE

TWO little girls are better than one;
Two little boys can double the fun;
Two little birds can build a fine nest;
Two little arms can love mother best;
Two little ponies must go to a span;
Two little pockets has my little man;
Two little eyes to open and close,
Two little ears and one little nose,
Two little elbows, dimpled and sweet,
Two little shoes on two little feet,
Two little lips and one little chin,
Two little cheeks with a rose shut in,
Two little shoulders, chubby and strong,
Two little legs running all day long.
Two little prayers does my darling say,
Twice does he kneel by my side each day,
Two little folded hands, soft and brown,
Two little eyelids cast meekly down,
And two little angels guard him in bed,
One at the foot, and one at the head.

THE THREE OLD LADIES

THERE was an old lady all dressed in silk,
Who lived upon lemons and buttermilk;
And, thinking this world was a sour old place,
She carried its acid all over her face.

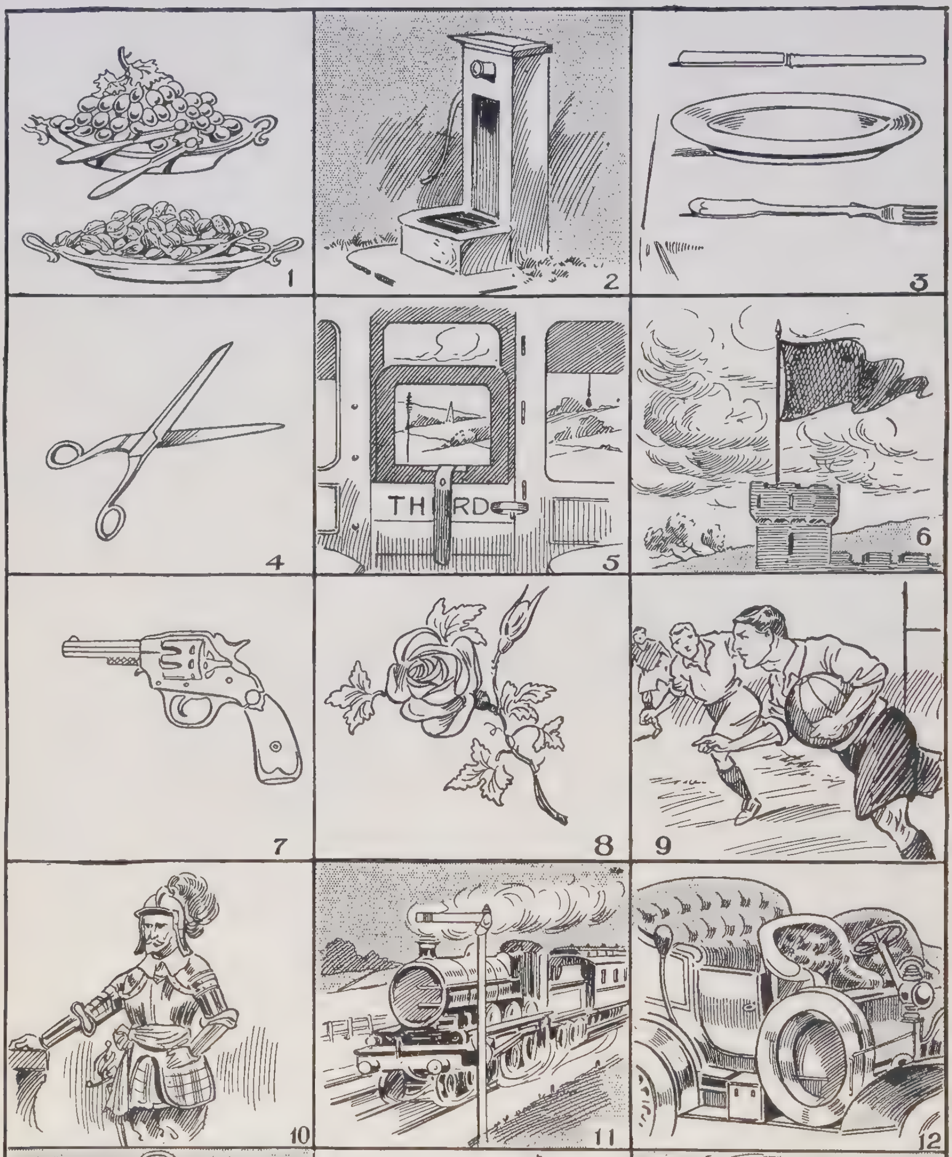
Another old lady, all dressed in patches,
Lived upon nothing but lucifer matches;
So the world, it made her strangle and cough,
And sure as you rubbed her you set her off.

Another old lady, all sunny and neat,
Who lived upon sugar, and everything sweet,
Exclaimed, when she heard of their troubles, "I never!
For the world is so nice I could live on for ever!"

Now, children, take your choice
Of the foods your heart shall eat;
There are sourish thoughts, and brimstone thoughts,
And thoughts all good and sweet.

And whatever the heart feeds on,
Dear children, trust to me,
Is precisely what this queer old world
Will seem to you to be.

WHAT IS WRONG IN THESE PICTURES?



There is something wrong in each of these pictures. It will help us to cultivate our powers of observation to try to discover the mistakes the artist has purposely made. They are pointed out on page 3442.

A NEW GAME TO PLAY WITH THE ATLAS

CONTINUED FROM 3218

GEOGRAPHY is one of those subjects which we have to learn at school, and which may be either very interesting or very uninteresting, according to the method by which we learn it. If we sit down with a geography book and try to learn off a bare list of the twenty largest manufacturing cities in the United States, the subject is very dry indeed; but if we read a bright account of a journey among these cities, with some graphic facts about the things that are made in them, and follow upon a map the course taken in the journey, then we find real pleasure in the lesson, and the names of the places are learned for good.

It is always difficult to remember the outlines of the different countries and islands shown in the atlas, yet we ought to know these shapes at sight. To keep on drawing the maps again and again, in order to fix the outlines on our minds, is dull work; but there is a method of learning the shapes of the countries so that we shall never forget them, a method that is a game rather than a lesson.

We take the atlas, and, copying the outlines of certain countries and islands on paper with a blacklead pencil, we look at them carefully and try to think what familiar objects they are like. Then alongside each country we draw the object which it resembles, keeping very closely to the outline of the map.

It is astonishing, how many of the countries and islands and seas can be turned into pictures of things with which we are all familiar. Italy, for instance, is remarkably like a big riding-boot; New Guinea is like a smiling bird; South America is like a bearded monkey; Lake Erie is like a whale; and so on. Having drawn a map of a certain country, and with a few touches changed it into a bird or animal or fish, we shall never forget the general outline of that country.

How the maps are made into pictures.

This game of making picture maps is one that we can play when alone, or it may be used as a round game for a party of any number. Half a dozen countries or islands or seas are mentioned, and their names are taken down by the competitors. Then atlases are opened, and the outlines of the countries are drawn by each player on pieces of paper, room being left at the side for the duplicate outline changed into an animal or some other object. When all the maps are drawn, a certain time is allowed for the pictures to be made, and the drawer of the best picture is then declared the winner, the relative merits of the pictures being decided by the votes of the competitors themselves, unless some older person is present, and is willing to act as judge.

A little alteration is permissible, but not so much as would alter the outline of the map.

THE DANCE CALLED LAUDNUM BUNCHES

LAUDNUM BUNCHES is a corner dance, and many of the movements are typical of other dances. The dancers wave a handkerchief in each hand, holding it in one corner between the thumb and fingers, and wave it from the wrist with the arm upraised, as shown in picture 2. Some dancers secure it by twisting it round the finger. Laudnum Bunches seems a strange name for a dance. "Laudnum" is possibly a contraction of laudanum, a sweet-swelling gum, which used to be prepared from the leaves of a shrub and was utilized in making a perfumed powder. If this is so, the connection of a scented powder with handkerchiefs is accounted for.

The six dancers stand in two files and jump. Then the two files advance, so that the last couple are in the same spot as that where the first couple were before. Handkerchiefs are flung up while dancing at the fourth count of the step. The couples then retire and turn to dance facing the other way. The music is in six-eight time for these different movements, and just as the dancers get back to their original position they jump in half turning so as to face each other again.

With the change of music the movement called Corners starts. This reminds one of the familiar Sir Roger de Coverley dance.

The dancers stand facing each other, and Nos. 1 and 6 advance to pass each other and change corners, dancing the Morris step, and tossing up handkerchiefs, as shown in picture 2. Then turning about they face one another, and again approach as before, but only to the centre, and then retire to the same corners

2. Tossing up handkerchiefs in the Corners figure.

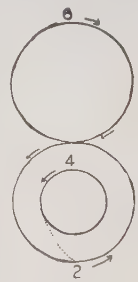
waving their handkerchiefs round their heads, and finally take a jump.

Next, Nos. 2 and 5 do exactly the same as the first couple.

Then Nos. 3 and 4 do just the same as the other two couples have done. All the dancers are now in opposite places. The music then alters to the original tune, and the dancers stand in file ready to start the Chain, which is practically a figure 8, and is a movement which is quite unlike the chain in the Lancers, where the dancers join hands, Nos. 1, 3, and 5,

3. Back-to-Back movement in Laudnum Bunches.

forming an S, and Nos. 2, 4, and 6 doing likewise. This is shown by a diagram below illustrating the movements of Nos. 2, 4, and 6.



The path of No. 4 is shown inside the path of No. 2 for the sake of clearness, but when No. 4 comes to the starting-place of No. 2 she begins following in the path of that dancer. Likewise No. 6 follows the path of No. 4 part of the way. At the middle of the chain the partners jump round to face each other again. The movements are reversed to finish the chain. Nos. 1, 3, and 5 dance the chain in the same way as their partners.

Next, the Corners are repeated. Following that is Crossing-over as in Bean Setting.

The next part of Laudnum Bunches shows the "high" step. Partners stand facing each other, and Nos. 1 and 6 start the Capers. They advance towards each other, handkerchiefs flung up as in Corners, jump in the centre, then pass on to each other's corners, hopping alternately on left and right feet, and keeping knees stiff and feet high. Then they turn round to face and advance half-way. The time changes, and they retire, waving the handkerchiefs round the head and dancing the same step as in Corners. Then they jump. The other couples do likewise.

The Back-to-Back movement is like that in Bean Setting. It is shown in picture 3, where the couples are dancing back to back round their partners. The repetition of Capers brings partners into their right corners again.

At the signal "All in," when the last couple is finishing, the dancers close in towards the centre, and as the music ends, toss up their handkerchiefs and make the "call."

THE DANCE CALLED BEAN SETTING

THE dance Bean Setting is so called because it illustrates the planting of beans in spring, and thus joyously celebrates the hopeful seed sowing. Six dancers stand in two-file form, each with a short stick in the right hand, held like a pencil, as shown in picture 1, and crossed with the partner's stick. The partners face each other. The sticks replace the swords

1. Tapping sticks in the Ring figure in Bean Setting.

used in the ancient dance. The music of this dance starts with twelve-sixteen time, and the sticks are tapped on the ground or crossed in time with it. The dancers in their movements cover a space of about twelve feet each way.

Dancer No. 1 is the leader, who calls out the figure or movement and makes known to his five comrades the end of the dance by the call "All in."

The first figure, named the Ring, starts by partners tapping sticks as shown in picture 1; then all the dancers form a ring, Nos. 3 and 4 moving a little out from their places, and then the whole six dancing in step to form half the ring. They then tap partners' sticks and circle the other way. In the picture which we see on the top of page 2805, they are shown dancing this Ring figure. The change which then takes place to jump into the position facing the music in two files is shown by the following diagram:

5	SIDE BY SIDE WITH	6			2	FACING	1
3	do	4	ENDING IN		4	do.	3
1	do	2			6	do.	5

The arrows show how the ring is made, and the column on the right hand shows the new positions that are taken by the dancers.

In the second half the ring starts forming again, but when the dancers step out they do so in the reverse direction, as shown here:

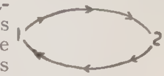
2	SIDE BY SIDE WITH	1			5	FACING	6
4	do	3	ENDING IN		3	do	4
6	do	5			1	do	2

It must be noticed that when the dancers arrive in position facing each other, half-way through and also at the end, they make a half-turn jump into the file position again, and tap sticks across.

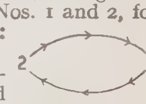
The next figure, Dibbing, imitates making holes for the setting or planting of beans. The music changes, and the partners face each other in two lines, holding the sticks in their right hands pointed down, and stooping forward. The stick is dibbed, or struck twice on the ground. The dancers stoop, and partners cross their sticks and tap them, letting the sticks remain crossed as seen in picture 1.

Dancers then tap their partners' sticks again, but instead of letting the sticks remain crossed, No. 1 taps No. 3, No. 3 taps No. 5, No. 5 taps No. 6. With the change of music No. 6 taps No. 4, No. 4 taps No. 2, and this tapping all round ends by partners tapping and crossing sticks. Sometimes the Chain as described in Laudnum Bunches is danced here to lengthen the dance, which, though it seems lengthy, is very quickly performed.

The name of the next figure, Crossing-over, indicates the movement. Partners face, cross over and take each other's place, dancing the Morris step. For instance, Nos. 1 and 2 dance to opposite places, keeping each other on the right, and end by turning and facing each other, as shown in this diagram.



Then all the couples dance in step round to the right in order that partners may get into the original position, facing each other again, and tap across. Nos. 1 and 2, for instance, then dance like this:



Dibbing is now repeated.

In the Back-to-Back movement partners advance and pass each other with right shoulders opposed, turn to the right half-way round each other back to back, and, with left shoulders opposed, retire into position backward. Nos. 1 and 2 move like this:

Tapping partners follows with the change of music. The movement of advancing and retiring is repeated, but partners dance forwards to the right of each other, opposing left shoulders in advancing, right on retiring.

Dibbing is repeated for the second time. Crossing-over is sometimes repeated here, and is followed by Dibbing again. At the call "All in," and as the music ends, the dancers form in two files with their sticks crossed.

HOW TO MAKE OUR OWN EASTER EGGS

THE Easter egg is a beautiful idea. It is a symbol of the return of spring, for the egg contains in it, in a mysterious way, the promise of life. All over the world friends give and take presents of Easter eggs; in the country, perhaps, a basketful of the freshest new-laid eggs; but in town some of us may receive a pretty nest, or fancy basket, of candy eggs. Let us see if we can make some Easter eggs ourselves.

We might weave a little basket, or doll's hamper, as described on page 2137. In that we might put strips of torn white or pink tissue-paper. The eggs to go in the little hamper are real ones, well washed, and then, to make them firm, boiled for about ten minutes in a saucepan of water, colored in some way. A few drops of cochineal will turn the water red and color the eggs. Spinach water will turn them green; water in which onions or gorse-flowers were boiled, yellow. We can get mauve by boiling violet-blossoms; blue by using washing-blue. The water and eggs are taken out of the saucepan, and the eggs left in the water five minutes longer. The eggs, when colored, are carefully dried and rubbed over with a cloth dipped in sweet oil, and placed on a dish to dry. We then pack them in the hamper, and direct it with a message on a card.

1. An owl egg.

2. An old man egg.

Picture 2 shows a funny surprise egg for the breakfast table. All we want for it is a pen and ink to draw the face and hair, and a little cap of red Turkey twill. Easter egg dyes may be used to decorate the eggs. Many are the faces and animals we can turn our eggs into by decorating the shell.

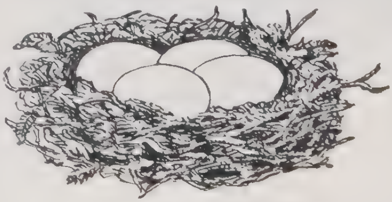
Surprise chocolate eggs are a good idea. Boys who collect eggs and know how to "blow" them will find these easy to prepare. The empty shell is stood on its broad end, and two or three drops of melted chocolate are poured through the top hole. This must dry and harden to stop up the bottom hole. Then the egg is filled up with melted chocolate. To get this we take a bar of chocolate, put it in an empty jam-jar, and stand it in a pan of boiling water until the chocolate is melted, and can pass, by a funnel, through the hole in the egg. A little white sugar will cover up the dark spot, and great will be the surprise when the egg is cracked at table.

The owl shown in picture 1 is a surprise egg of this kind, with little discs of crinkled paper for the eyes, a peak behind for the head, and two pieces for wings, all of which are stuck on with a drop or two of gum. The feet are of bent wire, which is also neatly bent into the form of a ring, in which the egg stands. That is easily done if we remember the barn-door cock made of bent wire as described on page 937.

We might make four surprise chocolate eggs and put them in a nest—not a real bird's nest, but one we can make ourselves. We first get some twigs and twist them together in the form of a nest—of course *ten* fingers can do what *two* small bills can do. A little glue will secure the twigs in place, and between them we arrange some real or artificial moss. Failing that, we can color some green, or shred a little green crinkled paper. Pad the nest with little bits of cotton-wool and a downy feather or two, and then it is ready for the eggs, as shown in picture 3. A small basket, deep or shallow, is a good substitute for a nest.

A surprise egg might be filled with a sweetmeat of icing sugar, which is pure and wholesome. Take some icing sugar and dissolve it in a few drops of cold water, so that it will run through the small hole in the shell and fill the egg. Then place the egg in boiling water a few minutes to harden it. The icing can be made pink by adding to it a drop or two of cochineal.

A novel idea is to shape an egg out of dates coated with chocolate or icing sugar, or both. We take three large, perfect dates, and, having broken them open lengthways and taken out the stones, press the fruit together into as compact an egg-shape as possible. Their stickiness will keep the dates together. We then dip them in melted chocolate several times till they are well coated, and cover them with icing. Two table-spoons will help us to get the egg-shape.



3. A nest of Easter eggs.

The pretty eggs in the shops are not always fit to eat, but the delicious little eggs shown in picture 4 are made of marzipan and sponge-cake. We get a quarter of a pound of ground almonds, a quarter of a pound of white powdered sugar, and one crumbled and sifted stale penny sponge-cake. We put these into a bowl, and mix them with one egg and a few drops of essence of almonds, using a fork first, and then the fingers, and tasting the mixture to see that the flavoring is right. We then take a lump and shape it into the form of an egg in the palm of the hand. No cooking is needed, but the marzipan is better for being kept a day. If we want the eggs quite white, we can coat them over with a little sugar icing, made by moistening some icing sugar with a little cold water—only a drop or two. The eggs must be set to dry and harden in a warm place. These little eggs will look nice if they are put into a screw of brown paper tied round with narrow yellow ribbon.

4. Marzipan eggs.

A LITTLE VEGETABLE GARDEN

WHAT TO DO IN THE MIDDLE OF MAY

ONE of the important mid-May operations is weeding. Weeds grow apace at this season, and we have to remember that they are taking the goodness from the soil that our vegetable plants should receive. Our bed of onions must have special attention, and this we must certainly *hand* weed, as it will not be safe to use even a small hoe among our little plants. In fact, it will be a good rule to hand weed entirely among all our young and growing crops.

We may still sow lettuces, cress, and radishes to yield a supply when those already growing are finished. And let us always bear in mind that sowing should be done on ground that has been deeply dug, and then allowed a little while in which to settle; and we may even sow another row of peas if we have not sufficient already in the various stages of growth. It is very important to put sticks to our peas, and later on to our runner beans, directly they need support. They soon feel the need of something round which to grow. But we set up our pea-sticks, and still, perhaps, find that not quite every plant is able to reach them. In this case let us take some short twigs and branches, and place them close beside the little plants to help them until they find their way to the larger sticks. These are small matters, but they all help towards success.

In some places young gardeners will find themselves greatly troubled with slugs. These greedy insects may be dealt with by putting ridges of soot, or soot and lime, round the plants. Night is their feeding time, and many people find one of the most successful ways of catching them is to go out with a lantern about ten o'clock and pick them off their young plants and the soil, and destroy them. Another remedy is to cut slices of turnips or potatoes and place them on the soil. When they are lifted, numbers of slugs will probably be found on the under sides of them.

But after all our best friends in the matter of slugs and other insects are the toads which have large appetites for such food; therefore, instead of killing them, we should do everything to encourage them.

If we sowed our string beans quite early they are perhaps at this moment our most forward crop. We should have thinned them, if necessary, before this, and must now keep a look-out for the tiny black aphis—an insect which infests the leaves; we should pick off all leaves on which these insects are seen and destroy them.

The squash and pumpkins are interesting to grow, different in character from most other things in our gardens. But it is a tender plant, and if we are waiting to sow the seed out of doors it had better not be done until the third week of the month, and then only if the weather is favorable. In many gardens these succeed better if raised above the level than if grown on the surface; we therefore make a mound with stable manure and leaves, and several inches of soil, and on this sow our seed. When the seedlings are through the soil, it will be a good thing to put empty pots over them for the night, as a slight protection for a little while. And we may give the same treatment to ridge cucumbers, if we choose to grow them.

For planting out our little cabbage plants, Brussels sprouts, and others as they become forward enough, it is well to choose showery weather, as this is helpful to growth. The time for this operation will depend upon the size of the plants. If it is a very dry time we may water the soil, and the next day plant them out, and then give them a watering in their new quarters. Young gardeners may be inclined to use the watering-can too freely. This is a mistake, for it means sour, saturated soil. We should water only when the surface is really dry. We may even scrape the soil away and examine it an inch or two below the surface, and if we find it moist we need not water that day.

Perhaps we have two or three gooseberry bushes in our little garden plots, and have decided that some of the fruit shall be picked unripe for tarts, leaving the rest to ripen. The unripe fruit should be picked from those trees which are in shady positions, as they will never become so sweet or so good as those in the full sunshine.

Looking ahead, the present season is a good time to sow the seed for next year's wallflowers.

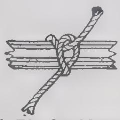
The best way is to sow in some little spare patch among the vegetables, and afterwards to transplant the little seedlings farther apart, and then in the autumn to put them in the positions in which they are to flower. It is very useful to use our vegetable garden in this way for seedling plants of flowering subjects that are not due to flower until next year, and if we like we may sow the seed now of forget-me-nots, sweet williams, canterbury bells, honesty, and of many other similar flowering plants.

We must be careful to hunt for insects—grubs, caterpillars, and green-flies—on our rose leaves. Those rose-trees which we pruned so carefully at the end of March or early in April will by this time have grown a good deal. If we find a leaf curled round, or apparently fastened down one side over the other, and examine it, we shall find there a grub, which will in time become a young caterpillar, ready to eat the rose leaves and often destroy buds. There is nothing but hand picking to get rid of this pest. The little green-fly may also become troublesome, and here also we shall find that the fingers are more useful than anything else to clear it away. We may water the rose-trees, and occasionally give them manure water, mixed with clear water and soot water.

Our annual plants need careful attention and should be trimmed as severely as the little vegetables. Poppies will not bear transplanting, but most of the others can be used in different positions if the roots are not injured as we lift them.

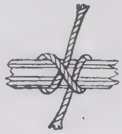
SAILOR'S HITCHES AND SPLICES

ON page 251 we saw how sailors make knots. There are other ways in which sailors must make use of ropes—for instance, in making hitches, which are really a kind of knot, and in splicing ropes; that is, joining



1. The half hitch.

2. The timber hitch.

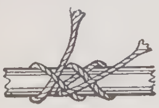


3. The clove hitch.

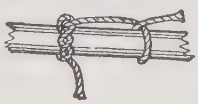
two ropes together by uniting their ends without knots. In this article we see how to make hitches and how to splice ropes.

We show the simplest in picture 1. It is called a half hitch. We pass the end round a bar and its own standing part, and then down between its own part and the bar. The next, called the timber hitch, is made in the same way, except that the end is passed not once but several times round its own part, as seen in picture 2.

In making the clove hitch, shown in picture 3, we pass the end round the bar, cross it over the standing part, pass it round the bar again, and then pass it between its own part and the bar. The rolling hitch is made in the same way; but the second half of the operation consists in passing the rope twice round the bar, and in passing the end under both the turns, as in picture 4. The timber



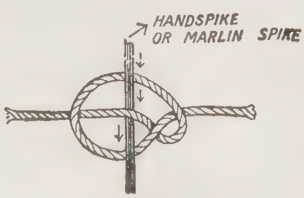
4. The rolling hitch.



5. The timber and half hitch.

and half hitch is a combination of two hitches which we have already seen, and is made by making first a half hitch, and then making a timber hitch with the end part, as in picture 5.

Now we come to what is called the handspike hitch. This hitch is frequently used by sailors when the two ends of the rope are fastened, and when they wish to exert pressure upon the rope. We make a loop in the rope first, and then pass the end of the bar through the loop, under the rope, in the loop, and then out through the loop again. It will then be as seen in picture 6. When we pull out the bar again, the rope is free, without any knot or hitch at all.



6. The handspike hitch.

The Blackwall hitch, picture 7, which is used on board ship for suspending cargo from the hook of a crane, is made by passing the end of a rope round the back of the hook and under its own part, taking care that the two parts of the rope are on opposite sides of the hook.

The fisherman's bend is used to fasten a rope to a shackle or ring. To make it, we pass the rope twice round the ring, and put the end through the turns. For security, the end must be tied to the standing part with strong string, an operation that is called "stopping back," as seen in picture 8. The round turn and half hitch is made in the same way, except that the end is passed through only one of the turns, as seen in picture 9.

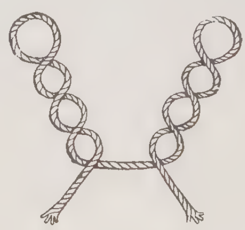
7. A Blackwall hitch.

8. The fisherman's bend.

9. The round turn and half hitch.

The series of loops seen in picture 10 is what is called a catspaw. We take a part of the middle of the rope, and form two bights, one of which we take in each hand and twist around an equal number of times, thereby making two loops, one at the end of each of the bights. A bar or spike may now be passed through the two loops.

We now come to the splicing of the ropes. This is more difficult than making knots or

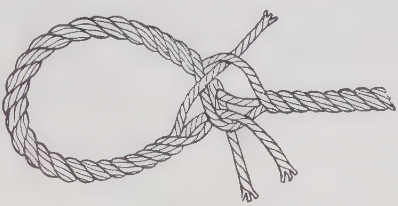


10. A catspaw.

hitches, but it is a very valuable accomplishment, which, if once properly learned, should never be forgotten by us.

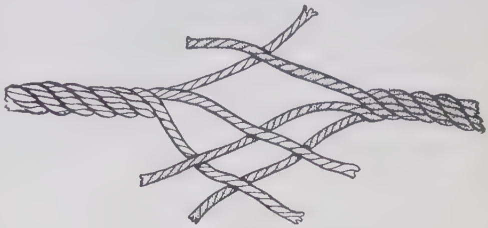
The eye splice is the method of making a permanent loop at the end of a rope. We take the end of the rope and unlay or open out the three strands for about 4 inches. Then we place these against the standing part at the spot which will give a loop of the desired size. We take the middle strand, and, after prizing up one of the strands of the standing part, pass the free strand beneath it. We then pass the other two strands, one on each side, under

the other strands of the standing part, and work the loop up tight, slightly tapering the strands by pulling off a little of the hemp. The usual practice is to cut one or more of the yarns composing the strands of the rope. After the first tuck has been completed with all strands, we pass them under the strands of the standing part again, taking care that each free strand passes over one of the standing strands before entering beneath the next strand. The ends are now again further tapered, and the process repeated a third time. All ends are now clipped off short after the splice has been well hammered, and then fine spun-yarn is bound round the joint. Binding with spun-yarn, when done the reverse way to the lay of the rope, is called serving. These instructions and the illustration shown in figure 11, if followed carefully, will enable us to make a good, strong eye splice.



11. The eye splice.

To make a splice or join between two ropes, the ends of each must be unlayed, or unraveled, for a few inches. Then we fit the ends of each rope accurately together, so that the ends of one lie between the ends of the other. This is called crutching, or marrying the ropes. We now pass each strand over one strand of the opposite rope, and tuck it under the next strand. When this has been done once with each strand of each rope, as in picture 12, we taper the ends a little, and repeat the process a second time. We finally clip off the ends, and, if necessary, tie round with spun-yarn. A long splice is used where no increase in the circumference of the rope is required. To begin with, each rope must be unlayed about three times as far as for a short splice. Then the parts are married,



12. Marrying a rope.

as in making a short splice. Now we take one of the strands of the right-hand rope, and unlay it still further, filling up the groove thus made with the corresponding strand of the left-hand rope. This must be done till only a short end of the left-hand strand remains free.

We repeat the operation on the left-hand rope, filling up with the corresponding right-hand strand. We now have two long strands in the middle, and at some distance on each side of them there will be a very long strand and a very short one. We deal with each of these three points separately. We divide the strands at each point, and tie the corresponding divisions together, then take the ends at each point thus formed, and tuck them under the second strand, having passed over the first one. We must taper the ends, and tuck them a second time over a strand and under the second from it, then hammer and stretch the rope well, and cut off all loose ends. We ought now to have a rope almost as strong as if there had been no splicing, but as if it had been a rope made solid from the start.

HOW TO PREPARE A DAINTY TEA

EVERY girl, at one time or another, wants to give a tea-party, and she is anxious, of course, to make that tea-party a success. But it is not every girl who knows how to entertain her friends, even in this simple, delightful way. How should we set about it?

Of course, when we have invited our friends, and the day comes round, it is easy enough to find a confectioner's shop and to order some of the dainty cakes that will surely be on view there. But suppose we wish to be absolutely independent of pastry-cooks and confectioners, or suppose we are miles away from any shops. Be that as it way, we must make up our minds to be our own pastry-cook and confectioner, and make our own cakes.

Is it impossible? Not at all. With due amount of care, and provided that we do not undertake anything too elaborate, we can certainly turn out quite a charming little afternoon tea.

Suppose we arrange our little menu something after this fashion, the quantities, of course, depending entirely upon the number of guests expected:

Green butter sandwiches	Egg and anchovy sandwiches
One large cake	Small chocolate cakes
Small cakes	Almond jumbles
Brown bread and butter	White bread and butter

In cutting bread and butter, which must be our first consideration, we should always have two knives—one to butter with, the other, and the larger, to cut the rounds. And if the butter be hard and difficult to spread, it should be cut in pieces and warmed just to the right degree of softness, but on no account until it becomes liquid.

To make the green butter sandwiches, we pick the leaves from the stems of some fresh watercress, then, after being dried in a clean cloth, they must be chopped small. Now we take an ounce of butter, and with a knife mix the two well together, and add a small—the very smallest—pinch of cayenne pepper. This green butter should not be made until the day on which it is to be used, and the sandwiches are greatly improved if four sardines are skinned, boned, and mixed up with it. The

mixture is then spread on the bread, and made into neat sandwiches carefully cut into uniform size and shape.

To make the egg and anchovy sandwiches, we take two, three, or four eggs, according to the quantity required, and boil them hard. If they be placed in a vessel of cold water, they generally peel more easily than if operated upon as soon as cooked; also, it should be noted, eggs which are a few days old peel more easily than those that are very freshly laid. The yolks are separated from the whites, put into a basin, and well mashed with a fork, and a little anchovy paste or sauce is added to them and well mixed. This mixture must be covered until required for use. It should not be made until the day it is to be eaten. The sandwiches are made, shaped, and garnished in the same way as those already described. Sandwiches, and bread and butter too, when cut, should not remain uncovered any considerable time between the making and the eating. If necessary to prepare them some time in advance, the covers of vegetable-dishes may be mentioned as handy to place over them, or anything else that will effectually keep the air from drying and hardening them, will answer the same purpose.

We must now prepare the sweeter items—the cakes. Delicious little chocolate cakes may be made by mixing four ounces of flour, four ounces of sugar, four ounces of butter, a teaspoonful of baking-powder, and two eggs. We put all the ingredients together, beating the eggs separately and adding them last. We mix these well, and place them in a well-greased baking-tin. The mixture will require from a quarter of an hour to twenty minutes in a hot oven. When *quite* cold, cut it into strips and divide to half the thickness; spread a thick layer of chocolate mixture on the one half, and place the other half on it very neatly and carefully. The chocolate mixture is made by melting some sticks of chocolate in a little hot water to the consistency of very thick cream. If preferred, the cakes need not be split to half the thickness, but the chocolate can be poured over the top. Where this is done, the enthusiastic young cook may choose further to adorn with some pretty sweets placed upon the chocolate before it sets, or to use a preserved cherry for each strip.

For another dish of small cakes, we take the weight of two eggs in flour, butter, and sugar, and a quarter of a pound of currants, mixing all together thoroughly with one teaspoonful of baking-powder. If the mixture is scarcely moist enough as it stands, a small quantity of milk may be added. The young cook, however, should be careful on this point, as the tendency is to make cakes a little too moist.

To make the almond jumbles we must beat a quarter of a pound of butter to a cream, then add to it a quarter of a pound of castor sugar. We next mix separately two ounces of almonds beaten to a paste with the juice of a lemon, and one half-pound of flour. The whole is then thoroughly stirred together and mixed, made into small cakes, and baked for about a quarter of an hour.

The recipe for the large cake is omitted, as in almost every house there will be some favorite and long-tried recipe. But it may be well to add that the young cook must be very careful in baking her cake, the tin must be thoroughly greased, and for the first quarter of an hour after the cake has been placed in the oven it should not be looked at, in order to give it a fair chance to rise before the opening of the door sends a draught of cold air upon it.

It need scarcely be added that everything must be arranged as daintily and prettily as possible, and flowers placed here and there.

THE ROOM THAT IS ALL WRONG

ANSWERS TO THE PICTURE-PUZZLES ON 3218

On page 3218 we have a picture of the interior of a room with seventeen things drawn wrongly in it. Here is a list of what they are. The door by which we enter the room has the finger-plates and handle and keyhole on the wrong side, being against the hinges. Going round the room we notice, first of all, the pictures: the oval picture is hanging from a hook which is placed upside down on the picture-rail; the next picture, a landscape, is upside down; and the one hanging in the corner has no hook at all. Looking down, we notice that the skirting board is reversed. We shall be surprised to find that the maid is about to shovel on to the gas-fire some coal she has taken from a coal-scuttle which has quite an impossible handle. This handle is round the bottom of the scuttle in such a way that it could not possibly be swung round for the purpose of lifting the scuttle.

The hands of the clock are wrong, as the little hand would point to a minute or so past the hour instead of just before it, if the minute hand was at the quarter past the hour. Let us go and look at the window. The fastener is the wrong way round, and the handle by which we lift the lower half has been fixed on back to front. Casting our eyes upwards we notice that the support for the curtain-pole is fastened on the top instead of at the side, which would prevent us putting the pole over it, and the knob by which we open the shutter is on its wrong side. Moving round the room we come against a hassock, the handles of which are on the sides instead of on the ends. Let us take it up and we shall notice how very awkward it would be if hassocks were always made like this one. There is something strange about the dog too. It is a spaniel with a collie's tail. The chair behind it has been very carelessly upholstered, for the pattern is the wrong way up; the castor has been fixed on the wrong way round, and it would soon break with the weight of anyone sitting in the chair. Lastly, the floor-boards have been placed in in the wrong direction, and what would happen to them underneath the carpet is impossible to say.

THE NEXT THINGS TO MAKE AND DO ARE ON PAGE 3431.

READING

MORE PRONOUNS AND VERBS

CONTINUED FROM 3174

IT is quite a long time since we had any proper sentences to read. We were so busy learning about HE, SHE, IT, and all the other little words, that we forgot to have a real reading lesson. We shall be surprised to find how we have been getting on with our reading all the time, though we forgot all about it in our last lesson. Here are some words that we shall be able to read quite by ourselves:

The BLACK PEN is MINE.

The LARGER of the two BOOKS is THINE.

This PRETTY GARDEN is HIS.

That WATCH is HERS.

Do you see that HOUSE? It is OURS.

Is the BROWN DRESS YOURS?

I like our DOLLS better than THEIRS.

When you have read all those through, look back for a minute at the last word in each of the sentences. What do you notice about these last words? That they save us the trouble of using a whole lot of other words: one little word does instead of several. In the first sentence, if we could not use the little word MINE, we should have to say: The black pen is the pen belonging to me; and in the second: The larger of the two books is the book belonging to thee, and so on. So because these words MINE, THINE, HIS, HERS, OURS, YOURS, THEIRS stand "for nouns," they must be PRO-NOUNS, just like our old friends HE, SHE, IT. Only the pronouns we have just been learning are called Pos-ses-sive, because they show that the persons possess, or have certain things. The pronouns that we learned in our last lesson were Per-son-al.

Now, suppose I shut my two hands tight, and held them out to you and said: "Now, which of my two hands will you have?" And suppose you had been watching very sharply and seen me slip a piece of chocolate into *this* hand, and a little stone into *that* hand, you would answer, like a shot, THIS. And, do you know, when you said THIS you were really and truly using a pronoun. Yes, and a new sort of pronoun, too. You never thought you were doing that, did you? And because THIS and THAT are used when we wish to point out something (though we are taught it is rude to point), they are called Pointing-out pronouns, or (if we wish to sound very clever) De-mon-stra-tive, which just means "pointing out." Have you read any of "Alice in Wonderland," or "Alice Through the Looking-glass"? If so, you will know something about Tweedle-dum and Tweedle-dee. Here is more about them:

YOU have heard of Tweedle-dum,
YOU have heard of Tweedle-dee,
WE are both so much alike, that
YOU can't tell HIM from ME;
How handy IT would be if one were
thin and one were fat,
For then you'd say at once: "Why,
THIS is THIS, and THAT is THAT."

It is really very awkward when WE both
begin to dress,
Our clothes are so alike that we get in
a dreadful mess;
When I say "Tweedle-dum, my dear,
I'm sure this coat is MINE,"
HE always answers "Tweedle-dee, how
can my coat be THINE?"

Now we are coming to something new. We will begin by asking ourselves a few questions, and trying to read the answers.

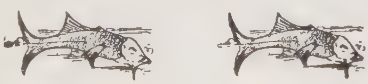
How do babies move about before they are able to walk? CRAWL

What do they do when they have grown a little bigger? WALK

What do you do when you want to get home from school quickly? RUN

How would you travel if you were a bird? FLY

And what do the little fishes do when they are asked out to tea? SWIM



And what do you do when you play hopscotch? HOP

Now, if you look at all those words that are printed in big letters, you will see that they all mean "doing something." They are not names of persons or things, like *man* or *table.* How silly it would be, when you were asked "How would you travel if you were a bird?" for you to answer "Table." And how everyone would laugh if, when you were asked "What are you sitting on?" you said "Swim." These two kinds of names are quite different, you see, and they must not be muddled up.

Now, we learned that the first kind of words was called NOUNS, and we had better learn for this lesson that this other kind is called VERBS. Every word that tells us something about what a noun is or does is a VERB. I think you will understand it quite well if we read a few more sentences together.

Cinderella LOSES her shoe.

Here LOSES tells us what Cinderella did, and so it is a verb. Cinderella, being the name of a person, is a noun.

St. George KILLED the Dragon.

In this sentence KILLED tells us what St. George did, and so it is a verb. In the next sentences, I am sure you can all pick out the verbs if you try:

Mary HAD a little lamb.
Who KILLED Cock Robin?
Tom, Tom, the Piper's son,
STOLE a pig, and away he RAN.
A stitch in time SAVES nine.
A soft answer TURNETH away wrath.
The Lord IS my shepherd: I shall not
WANT.
God IS love.
We LOVE Him because He first
LOVED us.

There is just one other thing that I must tell you, and that is, there must be a verb in every sentence. If you try to make a sentence without a verb, you may "try, try, and try again," but you won't succeed. Even in sentences with only one word in them, we find that word is a verb; such as HARK, LOOK, COME.

Now try to find all the verbs in this rhyme:

Hark, the clock strikes one, two, three,
We must give the dolls their tea.
Hark, the clock strikes four, five, six,
Nurse is calling Reg and Trix;
Now it's striking seven and eight,
Hurry up, or we'll be late.
By the time the clock strikes nine,
You're in your bed, I in mine.
But when the big hall-clock strikes ten,
I'm not awake to hear it then.
Eleven ends the big folks' day,
At twelve the fairies start their play.

TOM AND NORA LEARN TO WRITE FIGURES

"BEFORE writing anything new, let us see how you remember all the capital letters, writing them in the order of the alphabet," said Tom and Nora's mother when the time came for their next lesson.

When they had written all the letters like that, they took two pairs of nail-scissors, cut the paper into squares with a letter on each, and asked each other the names of the letters.

"There is something very different to learn to-day—we are going to make figures. It is quite as necessary to make good figures as letters," said the children's mother. "You can make 1 and 0 already."

Tom and Nora had learned how to count, so they watched their mother write these figures:

2 3 4 5

6 7 8 9

"So many people make bad figures, and then mistake them for each other; but much trouble might be saved by making figures clear and plain without flourishes. Before beginning to write, let us talk about these figures. Tell me what you see."

Tom noticed the figures were all between the lines except 7 and 9, which had strokes for tails below the line. Nora saw that 3 and 5 had their lower parts quite alike, but 3 had a smaller curve for the upper part, while 5 started with a short down-stroke and had a cross-stroke from the top of that to the right. Both decided that 7 must be quite easy to make—just a line to the right and a down-stroke, and that 9 was like 0 with a short stroke and a tail to the right of it.

"What about 4? Let us look at it upside down."

"Like a short 7 with a stroke through," said Nora. "Four is almost as easy as 7."

"6 is a curly tail," said Tom, "and 8 is like two little circles. Where does it begin and end?"

Nora said 2 reminded her of capital Q, but was ever so much smaller.

Then Tom and Nora took their pencils and copied rows of their mother's figures. They were puzzled to know where 8 started, but were told it should begin near the top at the right and curve up and round to the left, then down and round to the right to form the lower circle to join the beginning, and ought not to start the other way, for that would be like trying to wind a skein of wool from the wrong end. Nora smiled, for she had tried to do that very thing the day before.

When all the figures were nicely made, the children were shown how to put 1 before each figure to make the numbers 10 to 19, using the figures they already knew, just like this:

10 11 12 13

14 15 16 17

18 19

"Make the 1 quite distinct; never join it on to the next figure; and never start making it with a little stroke before it, for then it might be mistaken for a bad 7. The numbers from 20 to 29 are written with 2 before.

20 21 22

23 24 25 26

27 28 29

"In the same way we may use 3 for the thirties, 4 for the forties, 5 for the fifties, 6 for the sixties, 7 for the seventies, 8 for the eighties, and 9

for the nineties. All the other numbers are formed with the ten figures you already know."

For several days Tom and Nora practised making figures, and their mother gave them each a box of small square pieces of blank card, on every one of which they wrote a small letter, a capital letter, or a figure, and played at putting them together to make little words. At this time they were learning to spell short words, and so when their friends came to tea they brought out the boxes of their own letters, made words with the letters, and gave them to each other to find out the words they spelled. The one who made the most right words won the game. With the figures they made each other little sums to do, and sometimes they had a writing competition to see who could make the best and neatest letters in the shortest time.

Their mother was so pleased with their progress that she said they were ready to write words and little sentences, and that they should start to do so at the next lesson, and use pen and ink.

ARITHMETIC

SUBTRACTING SEVERAL NUMBERS AT ONCE

IN this lesson it will be well to go back for a while, and learn a little more about subtraction.

In Lesson 9 we saw how to subtract *one* number from another. Let us see whether it is not just as simple to take away several numbers at once from the other number.

The method we used for subtracting 347 from 635 was this. We placed 347 under 635, so that units were under units, tens under tens, and so on. Then we found what must be *added* to 347 so as to make 635. First, we made 7 up to the next number ending in 5—that is, 15, saying 7 *and* 8 make 15, and writing 8 in the answer. Next, the 1 of the 15 (which is 1 *ten*) makes the 347 into 357; so we went on, 5 *and* 8 make 13. Put 8 in the ten's place of the answer, and carry the 1 of the 13. This 1 is 1 hundred, and we therefore had 4 hundreds in the lower number, which required 2 more to make 6.

```
635
347
———
288
```

Now, by using this same method, we can easily take away several numbers at once from a given number. We have only to add the several numbers together, and make the total up to the other given number. An example will make this clear to us with a little explanation.

Take away the sum of 349, 17, 1241, and 406 from 5927.

Write the numbers down exactly as for an addition sum—that is, place all the unit's figures in a column, so that tens come under tens, and so on. Put the number 5927, from which the others are to be taken, first; separate it from those below by drawing a line under it. Next, add together the unit's figures of the numbers which come below this line. Say, 6 and 1, 7; and 7, 14; and 9, 23; or, what is better still, say only, 6, 7, 14, 23. Now, having found the total, 23, we have simply to say how much must be added to 23 to make it up to the next number above 23 which ends in a 7 (since the unit's figure of our top line is a 7). This number is, of course, 27, and we know that 4 must be added to 23 to make 27. We write 4 in the answer, and carry the 2 (tens) of the 27 to the next column.

```
5927
————
 349
  17
1241
 406
————
3914
```

We now repeat the process with the ten's column, saying 2, 6, 7, 11, *and* 1 *make* 12. Put 1 in the answer, and carry the 1 of the 12 to the next column. Next, for the hundred's column, we have 1, 5, 7, 10, *and* 9 *make* 19. Put down 9 in the answer and carry 1. Finally, 1, 2, *and* 3 *make* 5. Put down 3.

We see, then, that when the given numbers are subtracted from 5927 we have 3914 left. We can quickly test whether our answer is right by adding together all the numbers except the 5927. If the working is correct the answer, 3914, and the four numbers 406, 1241, 17, and 349 will make the number 5927.

This perhaps sounds rather difficult, but it only appears so because the explanation is long. The process is quite as easy as an ordinary addition sum. In the following example no

more has been written down than we actually say to ourselves in working the sum.

How much is left after 528, 1102, 347, and 129 have been taken away from 3016?

```
 3016
 ----
  528
 1102
  347
  129
 ----
  910
```

Say, 9, 16, 18, 26; and **0** make 26. Carry 2. 4, 8, 10; and **1** make 11. Carry 1. 2, 5, 6, 11; and **9** make 20. Carry 2. 2, 3; and 0 make 3.

As we come to each figure in heavy type we write it in the answer.

It may happen that all the numbers to be taken away are the same. In that case we can use our multiplication table.

How many marbles will be left out of 850 after 5 boys have each had 133?

Instead of writing 133 five times, we write it once, and place a 5 under its unit's figures, exactly as we do for multiplication. In fact, we are simply going to multiply 133 by 5, and make the result up to 850. Thus, we say, five 3's, 15; and **5** make 20. Carry 2. Five 3's, 15; and 2, 17; and **8** make 25. Carry 2. Five 1's, 5, and 2, 7; and **1** make 8. So, the result is 185.

```
850
---
133
  5
---
185
```

The following examples are to be worked in the way we have shown:

1. Take the sum of 782, 6031, 13, and 519 from 8207.
2. Find the remainder when 3912, 4608, 353, 97, and 1029 are taken from ten thousand.
3. Add together 129, 1008, 36, 508, and take the result from 3021.
4. Subtract 7 times 154 from 2540.
5. Subtract 8 times 643 from 5162.

MUSIC

THE "SLEEPY ARM" GAME OF THE FAIRIES

TO-DAY we are really going to think about the best way of getting the piano fairies to talk to us. They are very particular little people, and it is quite right to be particular, for there is always a right way and a wrong way of doing things, and we must be careful always to find the right way.

If we approach the fairies' kingdom—in other words, the piano—in the proper way, their voices will sound really beautiful; but if we *hit* the notes instead of loving them we shall get very little beauty from them.

How we should sit to play the piano.

First of all, we must find our seat, and we must place it so that when we sit on it we shall be immediately opposite the middle of the piano, and the seat must be far enough away to allow our elbows to be in front of our body. Now we will put our hands on the notes, but we will not press them down just yet. We have to be so sure that our fingers are rounded, that the back of the hand is quite level, and that we have a horizontal line from the elbow to the fingers. This must be our position when we play the piano. The little girl in the picture on page 3171 is not sitting in at all the right way.

The fairies know that all this is so important, they are very anxious for us not to forget, so we will make ourselves very safe and sure by saying it all over again.

1. Our seat must be immediately opposite the middle of the pianoforte.
2. We must sit far enough away from the piano to allow our elbows to be well in front of our body.
3. Our fingers must be nicely curved, so that we touch the notes with the little fleshy tops which Nature has given to us.
4. We must have the back of our hand quite level, and a nice horizontal line from the elbow to the fingers.

If we think of all this, and watch ourselves very carefully, the fairies will be very pleased. Even now they are anxious for us to feel quite happy, and not at all tired, so they say that if our legs are not quite long enough to reach the ground, we must have a footstool for our feet. Do you not think they are very thoughtful little people?

They have something else they want us to do to-day, as well; they say we must have a very *loose* arm, and a very *loose* wrist. When we want to walk we do not make our legs as stiff as a board, do we? We just let them move easily, and that is how we must walk on the piano, only we shall use hands and arms, instead of feet and legs.

Here is a little game which the fairies want us to play. They have a funny name for it, they call it "The Sleepy Arm." We can come away from the piano, and sit down anywhere we like for a change. We let our hand rest quite easily on our lap, then we throw it up above our head and keep it there while we count 1, 2, 3, 4.

Directly we have said "four," we pretend we go fast to sleep, and our arm will drop. It must be quite limp, just like it would be if we were asleep. Its own weight makes it fall, like a ball drops to the ground after we have thrown it up into the air.

Shall we see how easily we can make our arm play at being asleep before our next little talk? We will play this game ever so many times each day, for the more often we play it the more free will our arm become.

The fairies think we ought to have a story as well as a game, so here it is:

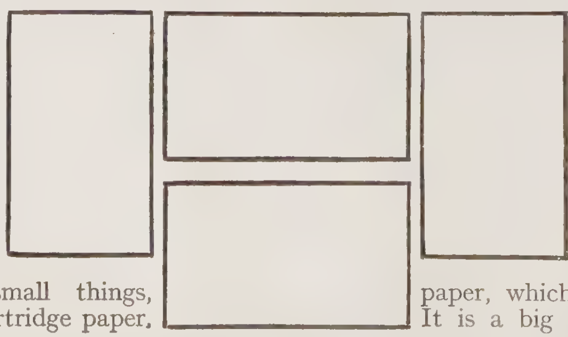
In the ever so long ago, there lived a little boy who loved the music fairies with a great and wondrous love. He had a toy which was his great delight—a wee orchestra of trumpets, horns, drums, and Jews'-harps. The father was not quite so fond of the music fairies, and tried to make his little boy forget all about them; but this was quite impossible, for when music was forbidden our poor little friend was very, very sad.

But there was a kind "somebody" who knew how the little one was fretting to hear the music fairies tell their sweet stories, and this kind someone managed to smuggle a clavichord into a garret in the top of the house. A clavichord, of course, was a musical instrument, which came before the pianoforte. There was one very funny thing about it. The lower notes which on our piano are white were black, and the upper notes which on our piano are black were white. It seems a funny instrument to us, but it made our little friend so happy, for he taught himself how to play. He used to go to the churches and hear beautiful music, and then he would come back and run away to his little garret, where his beloved clavichord lived, and persevere till he could make the fairies sing sweet songs to him. This little boy was George Frederick Handel, one of the greatest composers this world has ever seen.

DRAWING

PUTTING ON A GRADUATED WASH

IN our painting lessons we have always pinned our drawings on our boards. If our paper has been rather thin, or if we have soaked it too much, we may sometimes have seen that it has been crinkled on the surface, which, of course, entirely spoils a flat wash. When we are coloring only small things, and are using cartridge paper, this need not happen if we are careful to damp all the surface equally, and not too much; but when we want to color larger things especially well, we can try another sort of paper, and fix it to the board in a much better way.



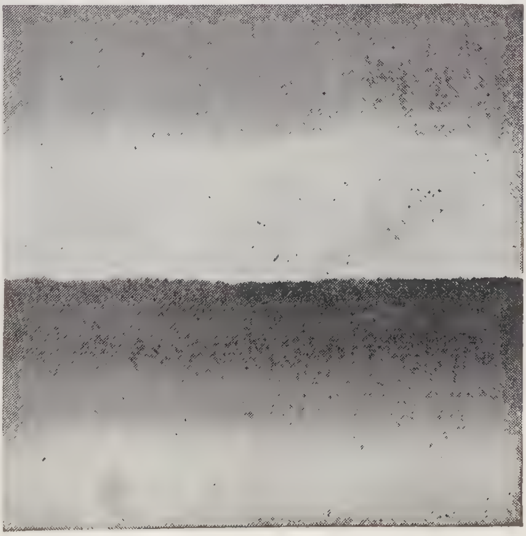
We will procure a sheet of water-color paper, which costs ten cents. It is a big piece, so we will

only use half of it to-day. Now, we shall want some good paste, or some very strong gum, with a brush or a sponge. We must take our paper and thoroughly soak it in cold water—the bath is the best place to do this. Then we must lay it on the board, and after squeezing the sponge well, press out some of the water in the paper all over with it till it lies quite flat. Then we lift up the edges and paste the board about an inch underneath the paper all the way round, then press the paper down and leave it.

This is a wash with one color.

We have only made our flat washes in one color all over, so far, even when we changed primary colors into secondary and tertiary colors. Now, we are going to put different shades of the same color on one part of our paper, and two colors together on the other part. We will first rule some oblong shapes on the paper. An oblong, of course, has two sides longer than the other two. We make the short sides three inches, the long sides five inches. We rule four oblongs, two with short sides at the top and bottom, and two with long sides at the top and bottom, in the position in which we see them on page 3334. We will paint our first oblong in blue to match the sky; but we cannot put in any clouds yet. We must just slightly damp the surface of the paper and blot it in the usual way; then we must take a brush quite full of blue paint, just wet enough to work easily, and paint one row along the top of the first oblong. For the next row we must dip the brush in clean water first, and then in the paint, and repeat this to the bottom. This fresh water, mixed with the color, will make it paler each time, till at the bottom row it is quite light — as if Oxford blue were at the top and Cambridge at the bottom. This is called putting on a graduated wash. We learned something about it on page 461.

We try this again on the other oblong, choosing a mixed color—green or violet—mixing plenty, because we cannot match the color again. On the two other oblongs we will use two separate colors. We can take two colors from the sunset sky—cobalt blue to light red, beginning with the blue as before; but halfway down we wash the brush and take a little light red, mixed with plenty of water to make it paler, and paint across next to the blue. The blue edge will melt into the first red edge, and as we go downwards the red shows by itself till it grows almost white on the bottom line. We will do the same thing with two other colors on the oblong that is left, and will then know how to put on a graduated wash.



Sea and sky made with Indigo and Cobalt.

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Aujourd'hui nous irons à Versailles, où demeurait une fois une belle reine.
To-day we shall go to Versailles, where dwelt one time a beautiful queen.
To-day we are going to Versailles, where a beautiful queen once lived.
Nous arrivons à deux heures, et allons en voiture au palais, un édifice splendide.
We arrive at two hours, and go in carriage to the palace, an edifice splendid.
We arrive at two o'clock, and drive to the palace, a fine building.
Nous traversons les chambres et regardons les beaux ameublements.
We traverse the rooms and regard the beautiful furnishings.
We walk through the rooms and look at the beautiful furniture.

Il y a beaucoup de tableaux sur les murs. J'aime les tableaux de batailles.
It there has much of pictures upon the walls. I like the pictures of battles.
There are many pictures on the walls. I like the battle pictures.
Nous voyons de drôles de lits. Ils ont un petit escalier sur le côté.
We see some droll of beds. They have a little staircase upon the side.
We see some funny beds. They have a little staircase by the side.
Les lits sont si hauts qu'on doit monter deux marches pour se coucher.
The beds are so high that one must to mount two steps for oneself to go to bed.
The beds are so high that one has to go up two steps to go to bed.
Nous quittons le grand palais et nous entrons dans Le Petit Trianon.
We quit the great palace, and we enter into the little Trianon.
We leave the big palace, and go into Le Petit Trianon.

La reine et ses amis demeuraient ici quelquefois dans de petites maisons.
The queen and her friends dwelt here sometimes in some little houses.
Sometimes the queen and her friends lived here in little houses.
Jeannette arrache un peu de lierre de la muraille et le met à sa robe.
Jenny plucks a little of ivy from the wall and it puts at her dress.
Jenny plucks a little bit of ivy from the wall and puts it in her dress.
Nous n'oublirons jamais le jardin de la malheureuse reine, Marie Antoinette.
We (not) shall forget never the garden of the unhappy queen, Marie Antoinette.
We shall never forget the garden of the unhappy queen, Marie Antoinette.

THE NEXT SCHOOL LESSONS BEGIN ON PAGE 3375.

An everyday scene in one of the sunny streets of the great Spanish seaport of Barcelona.

SPAIN AND PORTUGAL

CONTINUED FROM 3248

PHILIP II

ONE of the oldest fairy stories in the world tells us about the travels and deeds of a certain strong and daring giant, on his way from end to end of the Mediterranean Sea. The story was an old one when Greek children listened to it over 2,000 years ago. With the shining blue sea dancing before their eyes, it was easy for them to follow the hero, in imagination, to its very farthest end, where Africa and Europe nearly meet. For here, so the story says, to show how far he had gone, the mighty Hercules raised two huge rocks called "the Pillars of Hercules," and they stand to this day, one on each side of the narrow straits, just nine miles across, where the sea joins the ocean.

The far-famed rock on the European side, over 1,000 feet high, stands like a guard near the extreme south point of the Iberian Peninsula.

This great mass of land, which comprizes the kingdom of Spain and the republic of Portugal, is, roughly speaking, about 500 miles square, and it lies on the south-west corner of Europe between the Mediterranean and the Atlantic; the grand and rugged Pyrenees form its only land frontier. It has been said that Europe ends at the Pyrenees, so different in many ways is the country beyond them from the rest of the Continent. It is true that its Mediterranean shores, in their beauty and fertility, remind us of the shores of the other two southern peninsulas; and the coasts of the Atlantic and the Bay of Biscay can be matched in the West of France and the British Isles. It is the centre, the inner part—that is to say, three-quarters of the whole Iberian Peninsula—that is unlike the rest of Europe. This part is pushed up, as it were, some two to three thousand feet above the sea-level, and across this tableland or high plateau run several ranges of mountains, regular like the teeth of a saw, generally in an easterly and westerly direction, some thousands of feet higher still. Between these high ranges run most of the chief rivers draining to the Atlantic.

Bare, and bleak, and rugged, is most of this inland scenery, in strong contrast to the loveliness and warmth of that of the Mediterranean coast and of the three chief plains of the country. These plains lie in river valleys, one in that of the Ebro, which flows into the Mediterranean between the Pyrenees and the Iberian mountains; another in the valley of

the Guadalquivir, between the Sierra Nevada and the Sierra Morena; and the third is found along the western Atlantic shore, widening to the south between the lower courses of the Tagus and the Guadiana. The courses of these rivers of the plains present another contrast, for high up on the plateau where they rise, they flow, generally speaking, deep down in gorges, between rocky cliffs, useless for watering the land or for serving as routes.

The peninsula furnishes another contrast in the matter of its rainfall. The lands bordering on the Bay of Biscay are among the wettest in Europe; those on the central plateau are perhaps the driest, for the high Cantabrian mountains, the continuation of the Pyrenees along the coast, seize the moisture of the westerly winds—as our mountains do in the West—and the valleys of the deep northward slopes, falling 9,000 feet to the sea, are green and beautiful, growing many crops. Ferns and flowers abound, also all sorts of fruits, which ripen in the mild climate.

THE SUDDEN STORMS THAT SWEEP OVER THE SPANISH TABLELANDS

On the lofty tablelands on the other side of the mountains, which are only 2,000 feet below the peaks, the rain comes in occasional and sudden storms; so that at times the small rivers are dried up, while at other times the larger ones are apt to race unexpectedly down their rocky beds in swollen floods. Hot winds, too, blow at certain seasons over the plateau from Africa, and so we find scarcely any forests or crops upon it. Many sheep and goats of famous breeds feed upon the close pastures, shut in by the teeth-like mountainous walls so bare and rocky.

Round the straight coast of the Iberian Peninsula there is no fringe of lovely islands like those around the Balkan Peninsula; but we have the continuation of the range of the Sierra Nevada reappearing above the sea to the east as the Balearic Islands, often fought for by the surrounding peoples, though intended by Nature to belong to Spain. On them grow the same fruits and crops as flourish so well round the neighboring coasts. The people who live to-day in the corner lands of the Bay of Biscay say proudly that they are of the oldest race in Europe. They are the descendants of the earliest known people in the peninsula, the Iberians, who have given their name to it. They have always been distinguished for their passionate love of independence during the changes that have occurred in the passing centuries.

THE OLD ROMAN CITIES THAT HAVE BECOME GREAT AND FAMOUS

The Romans were the conquerors of the Iberians and the Celts, who came later and mixed with them, and many are the traces of their long stay in the land. Naturally, they settled much along the coast closest to Italy, and many of the cities famous to-day date from Roman times. There is Barcelona, with its beautiful clear air and fine climate; Saragossa, inland, is in the centre of the valley of the Ebro; Valencia, whose beauty has given rise to the saying: "You would take it for a piece of heaven upon earth." Toledo is on the Tagus, that "cuts out" its course on one of the Roman roads of the interior; and to the south, on the Guadalquivir, the "great river," rose up the splendid towns of Seville and Cordova. All these belonged to Hispania, whence we get the name Spain.

But it was in the province of Lusitania, formed round about the lower courses of the Douro, the Tagus, and the Guadiana, that Merida, the Rome of Spain, rose up in its grandeur. Here are still to be seen fine ruins of an amphitheatre, a circus, and an aqueduct, and to the north, over the wild rock-walled Tagus, is one of the grandest old bridges in the world. It is half as long again as Waterloo Bridge over the Thames, grey and stained with the weather of seventeen centuries. But the nation of soldiers and builders had to leave the fine roads and the camps, the cities and monuments of the peninsula, as they had to do in Britain and Gaul, when the empire began to grow weaker.

THE FIERCE TRIBES THAT POURED DOWN UPON SPAIN FROM THE NORTH

Hordes of German tribes, among them the Vandals and the Goths, poured down from the north and took possession of nearly the whole of the peninsula. By degrees the Goths gave up their fierce religion for Christianity, and churches and monasteries rose up over the country as the people became more civilized. But with civilization their character

seemed to grow weaker. There were many Gothic kings, some of whom held sway over the states that were forming, as the years went by, more or less on the lines of the Roman provinces.

Some of the states did not grow into shape till later on, though, broadly speaking, the provinces of to-day are survivals of the old states and kingdoms, and in most cases their great cities and towns were the old Roman capitals.

Catalonia, with its capital, Barcelona, Valencia and Murcia lie on the fertile east coast; and Andalusia, with its host of great towns, is on the south. These are the garden provinces of Spain, famous for flowers and palms, grapes and olives, oranges and lemons.

Portugal, on the lower Lusitanian Atlantic seaboard, stretches right up to Galicia in one broad strip. Cape Finisterre, the end of the Roman land, lies on the rocky coast of Galicia, sometimes called the Switzerland of Spain, and to the east of this land of independent spirited mountaineers lies Leon, named after the seventh Roman legion. Old and New Castile are on the central plateau, and Aragon is in the upper valley of the Ebro, with Saragossa for its capital.

The rule of the Christian Gothic kings over most of these states came to a sudden and tragic end at the beginning of the eighth century. Over the sea from Africa came a great host, sailing under a crescent banner; their watchword was "God is great, and Mohammed is His prophet." They poured into the peninsula under the shadow of the great Pillar of Hercules, that we call Gibraltar now, from Gebel-Tarik, the Rock of Tarik, who was the leader of these Moorish Saracens or Mohammedans. They landed in 711, and in the course of a few years the Moors spread over a large part of the peninsula, and on through the passes of the Pyrenees, over the fair plains of France as far as Tours. Here they were stopped by Charles of the Hammer, and the Mohammedan wave, which might have spread over Northern Europe, and even across the Channel, was turned back southwards by this victory, across the mountain barrier whence it had come. It was

The Spanish Peninsula juts into the Atlantic, the most westerly part of Europe. At its southernmost point it nearly touches Africa, and the narrow Straits of Gibraltar are commanded by the guns of a great rock fortress. No other country in Europe has a finer soil and climate, and yet half Spain lies uncultivated.

nearly 800 years before the last of the Moorish rulers was driven out of the peninsula itself.

Many champions rose up, and great efforts were made through the centuries to dislodge the "Pagans," the "Infidels," as the Christians called the Moors, who were equally anxious to spread the worship of Mohammed by crushing out the Christians. We know how Charlemagne, grandson of Charles of the Hammer, came fighting to the rescue, and how his nephew Roland made a most heroic retreat through the gloomy pass in the Pyrenees. Later, the great national hero, the Cid, or Conqueror, performed surprising feats against the Moors, which, like those of Roland, are the subjects of many favorite stories. Some English Crusaders came, too, and found pleasure and adventure in helping on the struggle. But for a long time the Moors held their own. Besides being warlike and fearless in spreading their faith, they were industrious and clever. They understood how to use rivers to water and fertilize dry soil. They were splendid gardeners, and introduced all sorts of new trees and flowers.

THE WARLIKE MOORS, WHO MADE SPAIN A FAIRYLAND OF GARDENS AND PALACES

But, above all, they were wonderful builders. As we travel over the peninsula to-day, amongst the greatest marvels that we see are the remains of Moorish buildings; their palaces and mosques, and the fortresses and castles which were built across the central highlands, are amongst the wonders of the world.

The foothold for the eventual reconquering of the country by the Christians was on the north. From the highlands of the Pyrenees and the Cantabrian mountains, the Moors were driven first over the Ebro valley. Then the kingdoms of Leon, Castile, Aragon slowly extended their borders. Next, Leon and Castile gained power by union, and the Moors had to retreat over the high plains and across Andalusia into the south. Their last province was Granada, which they held for another two centuries. During this time most of the Christian states were drawing closer together on their way to become one united Spanish kingdom. But Portugal stood alone. The Spanish and Portuguese people belong to much the same stock, and so do their languages. Geographically, there was no reason why this Atlantic province should remain distinct and independent when the others tended to unite. There is no natural division line between it and the rest of the peninsula.

HOW THE SEA CALLED THE PORTUGUESE TO CONQUEST AND DISCOVERY

Its mountains are the ends of the ranges of Spain; its chief rivers are the useful lower courses of the rivers of Spain. It had been overrun by the Germanic tribes like the rest of the peninsula, invaded by the Moors in the eighth century, reconquered from them by Leon, and was able, in the twelfth century, to set up the first of its independent kings.

Half the Portuguese boundaries are the rolling waves of the Atlantic, and even before the kingdom had settled down, the people began to listen to the insistent call of the sea, which is ever felt by those who dwell beside it; so they built ships fit for more than coast voyages. The story of how the Portuguese enlarged their borders over the neighboring western islands and onwards, and how they showed the way to India round the Cape of Good Hope, we read elsewhere. Prince Henry the Navigator, brother of King Duarte, or Edward as we would say, and a cousin of Henry IV. of England, did much to encourage the explorers. Voyagers sent out by this prince sailed round Cape Verde, on the west coast of Africa, long before Columbus discovered America.

THE KING AND QUEEN WHO MADE SPAIN ONE COUNTRY

Spain had not yet been united under one ruler, and the Moors still held Granada, the fairest province in the peninsula. But some years after the death of Henry the Navigator, Queen Isabella of Castile, who was his niece, was married to King Ferdinand of Aragon. Thus the northern kingdoms were brought together, and their armies were strong enough to bring the Moorish dominion to an end.

It was Queen Isabella who gave Columbus ships and men to make his great discovery. The story of this good queen is told on page 2445, and we have read on page 62 about the voyages of Columbus, and the great reception given him by the king and queen when he came back and told his wonderful tale.

THE ENEMIES OF SPAIN IN RETREAT

For nearly 800 years the Moors ruled in Spain, but gradually were pressed back, until, in 1492, their last stronghold, Granada, surrendered. Here we see King Ferdinand and Queen Isabella receiving the keys of the city from the last of the Moorish kings, who, as he looked back upon the towers he had left for ever, wept bitterly. The rock from which he took this final look is still known as "the Last Sigh of the Moor."

When Napoleon forced his brother Joseph upon the Spaniards as their king, they rose in revolt against the French army that had invaded their country. The English, under Wellington, went to the help of Spain, and the Peninsular War was the result. After much fighting Wellington inflicted a crushing defeat upon the French at Vittoria, and the French left the town a flying mob, as shown in this picture by R. Hillingford. Joseph Bonaparte only just escaped, leaving his carriage and even his private papers behind.

What exciting times they were! Columbus was pleading anxiously for help and men to cross the seas, and Isabella herself, dressed in armor, was in the midst of the army, while the siege of Granada was going on. The tent in which were the royal children was knocked over, and they nearly fell into the hands of the Moors. Little Catherine was there, who grew up to be the wife of Henry VIII., so familiar to us in English history as the dignified and unfortunate Catherine of Aragon. In the cathedral of Granada are still to be seen pictures, statues, and personal belongings illustrating those years, and amongst them is a banner worked by Isabella, which was hoisted over the conquered city when the Moors left.

THE FAIRY PALACE ON A HILL, WHOSE WALLS ARE LIKE LACE

For it became the favorite residence of Ferdinand and Isabella, and great was their interest and delight in the magnificent palace that had been built on a hill close by the city by generations of Moorish kings. The Alhambra, as this palace is called, is a marvel of Moorish decoration, and many travelers to Spain have recorded their delight at the glories of the numberless courts and galleries, the halls and lovely gardens with marble baths and fountains, of this wonderful spot. All is so beautifully painted and carved that the walls seem "woven like a cloth, rich as brocade, transparent as lace, and veined like a leaf." By moonlight especially it is a true fairy palace. All the decay of centuries seems to disappear under the soft silvery beams glancing through the fretwork and windows and flooding the open spaces. It all seems like a living enchantment straight from the romantic times of the Arabian Nights. And this is by no means the only beautiful relic from Moorish times. In Seville there is a palace in which the Hall of the Ambassadors is one blaze of lovely colors from the marble floor to the mother-of-pearl and crystal roof.

THE PINK TOWER OF PRAYER, FROM WHICH MEN WATCHED THE STARS

Here is also the wonderful tower, called the Giralda, built by the Moors as a prayer-tower, and for an observatory from which to watch the stars. Its color is a delicate pink; the view, from the top, of the bends of the Guadalquivir, amongst the sunny green plains, is most exquisite.

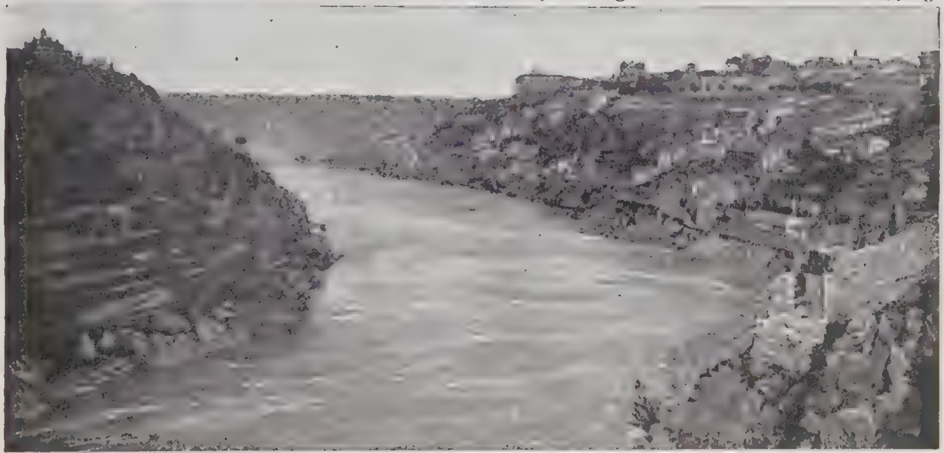
Both Catherine and her sister Joanna must have enjoyed all this beauty in their young days. It was the son of Joanna who became Charles I. of Spain, famous in history as the Emperor Charles V. He was ruler not only over a large part of Europe, but of an immense dominion on this side of the ocean, for in his reign Mexico, Chili, and Peru were added to the already large and rich belongings of Spain in the West Indies. Portugal had also won a large empire by the discoveries made by her sailors. We have learned in the story of South Africa of the possessions which she had held on that continent since the stirring times of which we speak, and she also gained the great dominion of Brazil in South America. At first it seemed likely that Spain and Portugal might fight over their discoveries. When Columbus returned from his first voyage, the Pope issued a bull or decree by which he gave to Spain all lands discovered west of a line drawn 100 leagues west of the Azores. Portugal, however, was not satisfied with this, and the next year—in 1494—a treaty was made between the two countries. By this treaty it was agreed that a line running from the Arctic to the Antarctic, and 370 leagues west of the Cape Verde Islands, should be drawn on the map, and that all new land discovered west of that line should belong to Spain, and all land east of it to Portugal. The line made by the treaty is the line of which we usually think when we speak of the Papal Line of Demarcation, or the boundary dividing the territories which the Pope believed he had the right to bestow on Spain and Portugal. As we know, neither France nor England paid any attention to this line, and though Spain sometimes claimed that Brazil was on her side, Portugal would not give up her settlements there.

Philip, the son of Charles V., married Mary Tudor, the daughter of Henry VIII. of England and Catherine of Aragon. Mary had just become queen of England, and Philip hoped to bring England, as well as the Netherlands, under Spanish rule.

This marriage was very unpopular, for the English people were afraid that liberty, chiefly in the matter of religion,

IMPORTANT CITIES OF SPAIN & PORTUGAL

Cadiz, one of the great commercial cities and naval centres of Spain, which was founded 3,000 years ago by the Phœnicians, has a fine harbor. Twice in the 16th century the English seized and burned the shipping.



Oporto, the second city of Portugal, stands on the steep, rocky bank of the river Douro, three miles from the sea, and has a large trade. It is famous for its port wine, which really means Oporto wine.

Cartagena is the principal naval arsenal and dockyard of Spain, and an important fortress. Its history dates from 223 B.C., when it was founded by Hasdrubal, the Carthaginian general, who called it New Carthage.

would be crushed by the same methods as in the bridegroom's country. In his grandparents' time a court had been formed with powers to inquire about everyone's faith, and to punish all who did not agree with the Church of Rome, to which, as a nation, the Spanish have always been firmly devoted. At first it was directed against the Mohammedan Moors and the Jews; but when, in Reformation times, men began to assert their rights to worship God in the way they believed right, all the terrors and cruelties of the Court were directed against them.

HOW THE LITTLE TOWN OF MADRID BECAME THE CAPITAL OF A MIGHTY EMPIRE

This Court of the Inquisition was busy in Philip's reign, not only in his own country, but in the Netherlands, and many people were tortured and burned because they would not return to the old faith. It was this Philip II. who chose Madrid, then but a small town, to be the capital of the newly united kingdom of Spain. It is near the centre of the peninsula, and is now one of the finest cities of Europe, though it has no natural advantages for a capital, beyond its central position. It is on a high, bleak plateau, dry and shadeless, surrounded by grey rocky mountains. It has no navigable river; communication with the rest of the country was long difficult. Its climate is unbearably hot in summer, and piercingly cold in winter.

THE PRICELESS ART TREASURES THAT ARE STORED UP IN MADRID

Since Philip's day magnificent buildings have been erected by succeeding sovereigns. It would take months to see the splendid pictures, not only of Spain's greatest artists such as Velasquez, of whom we read on page 764, and Murillo, but of the masters of Italy. We can find illustrations for all Spanish history in the galleries and in the National Museum, and in the famous collection of arms and armor. Here are the swords of Spain's noblest champions, of Roland and of the Cid; here are banners and tents taken from the enemy, from the times of the Goths and Moors.

About thirty miles away from the new capital, Philip built a country residence for himself, and joined to it a monastery, a church, and a burial vault for Spain's royalty, all in one enormous block. This is the Escurial. Its grand and gloomy style suits well the bare, rocky country in which it is placed. Philip said he wanted only a cell in which to rest his weary body, but his successors have beautified and enlarged the buildings in every possible way.

HOW KING PHILIP SAT SILENT WHEN HE HEARD NEWS OF A GREAT VICTORY

The seat in the church occupied by Philip when the news was brought to him of the victory of Lepanto, of which we read in our book, is still shown. It is said that he remained impassive till the end of the service, and then he ordered a solemn thanksgiving to be sung. The good news of this check to the sea-power of the Turks had taken just a month to come from the coast of Greece. Though in many respects the reign of Philip was the time of Spain's greatest riches and glory, he had many troubles, too; and his face looks weary enough in his portrait in the National Portrait Gallery, in London, which describes him as "King of England." The loss of the gallant Armada, with the failure of his plans upon England, was a bitter blow, and the constant "singeing of his beard" by the daring sea-rovers of that country must have been very trying.

To the south of Madrid is the district of La Mancha, made famous by Cervantes, who lived about these times, in his celebrated story of Don Quixote, which we read in another place. Here there are still old windmills to be seen waving their long arms over the dreary-looking country.

It was in Philip's days that Portugal fell to Spain, and remained united with her for sixty years, after which it reasserted its independence. The daughter of the first of its new line of kings was Catherine of Braganza, the wife of Charles II. Part of her marriage dower was Bombay, which proved to be an important foothold for England in India.

THE GREAT ROCK FORTRESS THAT GUARDS THE ENTRANCE TO THE MEDITERRANEAN

Soon after Portugal was lost to Spain, the Netherlands succeeded in shaking off Spain's heavy yoke. After this came endless years of war between Spain, France, Austria, and England, during which time Louis XIV. was for long a central figure.

One of the chief subjects of dispute was the succession to the Spanish throne.

THE MOST POPULAR SPORT OF SPAIN

Bull-fighting is the great national sport of Spain. You can see from this picture how the people crowd to the arena to see it, just as we crowd to see a base-ball or a football game. To our ideas, bull-fighting is a very cruel sport. It always ends in the suffering and death of the horses and bulls which are engaged in it, and sometimes some of the men are killed. The men who fight the bulls are called toreadors.

Picture from Underwood & Underwood, N. Y.

This is a picture of the roof and towers of the cathedral of Santo Domingo, in the old city of Burgos, the ancient capital of Castile. The cathedral, which is thought by most people to be the most beautiful church in Spain, was begun in 1221, but was not finished until nearly two hundred years afterward. The beautiful towers to the right are over the west door, and with the square central tower, or lantern, add great beauty to the building. The cathedral is built in what is called the florid type of Gothic architecture.

It was during this war in 1704 that Gibraltar was taken by the British. It withstood a tremendous siege about eighty years later. It is still the British flag that waves over this Pillar of Hercules guarding the entrance to the Mediterranean Sea and the route to India by the Suez Canal.

A few years later the fleets met again near the same part of the coast. This time it was off Cape Trafalgar, and on October 21, 1805, Nelson won his last and most famous victory. But, in spite of this and other checks by sea, Napoleon went his own victorious way by land in Prussia, Italy, Holland, and then came the turn of the peninsula. Some first aggressions having been passed over, France tempted Spain to agree to divide Portugal between them.

HOW THE OLD WORLD WAS RULED FROM THE NEW WORLD

The Portuguese royal family and the Court fled in alarm over the sea to their great possessions in Brazil. There the government was set up, and after Napoleon was driven from Portugal, that country was ruled from its chief colony until 1821. The king then returned to Europe, but the Brazilians were unwilling to become a mere colony again and declared their independence in 1822. The heir to the throne of Portugal preferred to remain in Brazil as emperor, rather than to return to Europe. Portugal was unable to conquer its former colony, and it has remained independent to the present day, though it is no longer ruled by an emperor.

Spain, however, did not secure a part of Portugal as it had expected. Napoleon took advantage of a quarrel between the King of Spain and his son, and a French army entered Madrid and proclaimed Joseph Bonaparte king.

But all Spain rose at Napoleon's action, and England, in indignation and alarm, quickly sent out supplies and two small armies under Sir John Moore and Sir Arthur Wellesley—who later became Duke of Wellington—to help to make a stand for the independence of the two kingdoms in the peninsula. For six years the war spread itself over the high tableland so difficult to cross and so trying in its extremes of climate. Heroic defences were made, and the peasants who lived in the little grey villages were always ready to rush out and harass the French. The defenders had some success in both Portugal and Spain, and then the tide was turned by the appearance of Napoleon himself. It is little over 100 years since Sir John Moore made a masterly retreat to Corunna in Galicia, where he lost his own life, but saved the honor of his troops. After this, Northern and Central Spain fell into the hands of France. Wellington, with fresh troops, gained a victory at Talavera which restored the fame of English arms. His next work was to wait patiently, holding his ground in the three famous lines of defence which he threw up at Torres Vedras, near Lisbon.

NAPOLEON'S VAIN BOAST AND HOW HIS ARMY WAS DRIVEN OUT OF SPAIN

At last his patience was rewarded, the French general had to give up trying to drive Wellington out of Portugal, and then the chance came of doing something in Spain. Napoleon had been obliged to draw away some of his best old soldiers to help in the war with Russia, and, in consequence, many towns in Spain were won back, and Joseph was forced to leave Madrid. So was rendered vain Napoleon's boast, "I hold it at length, this Spain so greatly desired," which he uttered as he put his hand on one of the white marble lions, as he went down the grand staircase in the Royal Palace of Madrid. Finally, after many ups and downs, the French were driven, after the defeat of Vittoria, across the Pyrenees. Months before that, the veterans who had so long held Spain for Napoleon lay frozen dead on the bitter road from Moscow.

The nineteenth century was a troublous one for Spain. By degrees she lost most of the colonies that had enriched her so much in the past. South America, Mexico, and Cuba became independent, Florida was sold, and the Philippines passed to the United States of America. There were also many disputes about the succession to the crown and the form of government, which led to civil wars and constant changes which nearly ruined the country.

THE BUILDING UP OF SPAIN UNDER ITS YOUNG KING AND HIS ENGLISH QUEEN

But now things are more settled. The constitution—for long a mere name—is observed. The young king, Alphonso XIII., has married an English princess,

and they have several children. Prosperity is increasing, as railways, which are very difficult and expensive to build in the central plateau, are gradually stretching over the country. Agriculture is improving, and more attention is being paid to mining and manufactures. Spain is very rich in metals; iron and coal are worked in the north, and the famous mines of Rio Tinto in the south supply a quarter of the world's copper.

In the year 1910, after a brief revolution, Portugal became a republic, and it is now hoped that its prosperity will revive. For size and population the country may be compared to Ireland.

splendid cathedral—the largest in Spain, famous for its rich sculpture and fine pictures. It is said that there is never a day in Seville when the sun does not shine; everything is bright and gay, the golden oranges, brilliant flowers, glossy palms, and white houses, with their pretty courtyards. Though the city is about sixty miles from the sea, fair-sized vessels can pass up the river and unload on the quay. After the return of Columbus from his first voyage, the city had a great trade with the Indies. In Seville are thousands of girls making cigars and cigarettes, and the dark little boys running about the streets might have been models for

When Philip II. came to the throne of Spain, he succeeded to an empire which a Cæsar might have envied. It was, in fact, the first empire upon which the sun never set. But Philip's policy led directly to the break up of this mighty empire. The break up began in his own reign by the successful revolt of the Netherlands, a revolt caused by the introduction of the Inquisition into that land. Here we see Philip in his palace at Madrid, accompanied by his priestly advizers, receiving a deputation from the Low Countries.

The capital of Portugal—Lisbon—was almost destroyed by a terrible earthquake in 1755, but it is now rebuilt, and is a beautiful and interesting city, doing a great deal of trade. From Oporto comes the wine known as port.

Many visitors go to Spain not only to enjoy the fine climate round the coast, but to see the grand old towns which show so many traces of the history of the country.

We have already glanced at the relics of the Romans and of the Moors. Belonging to the Christian times are magnificent cathedrals in nearly every city, and rich treasures of pictures.

The beautiful Moorish Giralda Tower in Seville is now the belfry tower of the

Murillo. Both the artists Murillo and Velasquez were born at Seville. Cordova, also on the Guadalquivir, was once the greatest city of the Moors, and the wonderful cathedral was once their chief mosque. A thousand columns of beautiful marble support the roof, and look like a forest of stone.

Toledo has a fine position on a rocky height, round the base of which the Tagus circles. Its cathedral is very large and rich, and at every corner of the ancient city are reminders of its strange and wonderful past.

The old Roman Barcelona has grown into a city ten times as large, and is now the first port in Spain, standing on one of the most lovely sites on the Mediter-

ranean shores. It is often called the Liverpool of Spain from its numerous manufactures and busy commerce. There is a fine view of the harbor from the lofty monument to Columbus. His figure on a golden ball is 23 feet high. It stands opposite the handsome street called the Rambla, shaded by trees, like the Unter den Linden at Berlin. There is also a handsome cathedral.

Cadiz, most picturesquely situated on a rocky peninsula, with beautiful bays and harbors, is sometimes called the Venice of Spain. It used to be its chief port. Much business is still done round the harbor. It has been said that the best impression of Cadiz would be given by writing the word "white" with a white pencil on blue paper—so blue are the sea and sky; so white the buildings! Nearly all the large cities of Spain lie on the coastal plains, on which two-thirds of the people of Spain live. Madrid, in which are about half a million inhabitants, is the chief exception.

The people of the Iberian Peninsula come of a very noble and dignified stock. Foreigners often consider them proud, but a great deal of their grand manner, especially amongst the peasants, is prompted by self-respect. The chief national amusement is the famous bull-fight, which is held in the chief cities at holiday times, and to which all the people go gaily dressed in their best, to watch the fighting of men with bulls. The animals are goaded and excited in every possible way, and great are the skill and daring of the toreadors. These men do part of their work on horseback, and it is terrible to think of the sufferings of the poor horses and bulls. The men, too, are sometimes badly hurt. It is a horrible and cruel thing, of which men and women ought to be ashamed, but, unhappily, other nations cannot say too much about the barbarity of it while they themselves hunt tame stags and shoot tame pheasants, and set dogs on to timid hares, and call it "sport." While studying or drawing the map of the peninsula of contrasts, or modeling its rugged surface, there is much to think over and "see" with the inward eye. We know where to look for green valleys and ashy mountains; for the gardens of vines, olives, oranges, nuts, and the trackless wastes. And as we glance round the long coast, what a pageant rises before us; of the Roman galleys, bringing soldiers and colonists; of the Moors pouring in near Gibraltar; of the little ships of Columbus sailing to the golden West, pilots of the rich treasure fleets—the "galleons of Spain" which Drake and others used to intercept; of the sailing of the mighty Armada, and from time to time the bridal trains of princesses on their way to become Queens of other countries.

The Alhambra, the home of the ancient Kings of Granada, has been described as a fairy palace out of the Arabian Nights, with walls as transparent as lace and veined like a leaf. It is surrounded by a mile of walls.

THE NEXT STORY OF COUNTRIES IS ON PAGE 3539.

WHAT THIS STORY TELLS US

WE have discussed the earth as a whole, and from many special points of view, and we have tried to dive down as deeply as possible—though that is not nearly deep enough—in order to find, far under our feet, the explanation for things that show upon the surface. But, before leaving this part of our subject, we must devote our attention to one particular part of the earth's surface which is, indeed, the most important of all—the soil, upon which living creatures depend for their food. We are all rooted in the soil, and without the soil not one of us could be alive. It is an absolute condition of the existence of thinking moral beings, like ourselves, that the very outside of the earth's crust shall be changed into this stuff we call the soil.

THE SOIL AND ITS USES

CONTINUED FROM 3254

THE more we know about our world, the more clearly does it look as if life were its great purpose. We are to think of the planet as a theatre, an arena, a mother, for life; and we have already seen that it is the life of the land, which breathes air, that reaches the highest. Now, when we examine into this life, we find that it all depends upon what happens at the very surface of the solid earth, where earth and air meet. We find, further, that the outer few inches of the earth's crust, or it may in some cases be a very few feet, become changed by the influence of air and water and light and life into something which we call soil.

We speak of soiling a thing, because the soil is rather messy, as if the soil were rather beneath our notice. But we know that animal life absolutely depends upon vegetable life for its existence, and we find that vegetable life depends upon the soil for its existence. So we may say that really everything that makes the existence of a planet worth while, that is to say, all the higher life which it nourishes, depends upon the processes which are ceaselessly going on just at the very outside of the earth's crust.

When we are in the country or at the seaside, we can see for ourselves what the soil means, because we can notice, for instance, at the top of a chalk cliff, or a rock cliff, a narrow layer which is evidently different from the rest; that layer is the soil. One may see it easily at the top of the famous chalk cliffs on the south coast of England, and if we study it there, we must understand that we are studying what goes on everywhere throughout the dry land of the earth, except in deserts, or where there is eternal snow and ice; and upon this process, which we can study so easily for ourselves, up to a point, is dependent the whole life of man.

If we look at the chalk cliff from the beach, we see that a few inches at the very surface, instead of being white, are brown; the chalk has been changed into soil by the process called "weathering." The brown color is due to iron, which, as we know, is a necessary condition of all life everywhere. Often the rain trickling down the side of the rock will carry a little of the iron with it, and so we may see little brown streaks staining the white surface of the cliff. Upon the surface of these few inches of altered cliff green vegetable life grows. Even since we began to study the story of the earth, a great many interesting and important facts have been made known about the soil, and we are fortunate in being able to learn them now.

We know that every living creature requires nitrogen as part of its food; we know, also, that about four-fifths of the atmosphere consists of nitrogen, and so the surface of the soil, and anything growing there, are exposed to this gas. Also, we can readily understand that, as

the soil is quite loose, there is a good deal of air in it, and this soil-air, as it is called, also consists mostly of nitrogen. So we should suppose that an ordinary green plant of any kind gets the nitrogen that it always needs, from the air in which it is bathed. We know that the green plant feeds upon the carbon dioxide in the air, and we might suppose that, as it must have nitrogen, it feeds upon the nitrogen too.

THE NITROGEN WITHOUT WHICH ANIMALS AND PLANTS CANNOT LIVE

Now, we ourselves, and the lower animals, require nitrogen; but it is found that, though it passes into our blood from the air, we do not use it, and anyone who does not get proteids, which contain nitrogen, in his food, will die of lack of nitrogen, even though his blood contains quantities of it. The reason is that he cannot use nitrogen except when it is combined with other things. Now, a very striking and unexpected fact has been discovered about green plants; they are exactly like us in this respect. Carbon dioxide they can feed upon, though we cannot; but neither they nor we can use the nitrogen gas of the air. This was proved by some Englishmen a little more than half a century ago. But it is perfectly certain that the plant must get nitrogen, and everyone who has to do with plants knows that they must be supplied in the soil with compounds of nitrogen. The question is: How are these compounds obtained?

We know that when there is a flash of lightning, or, indeed, whenever there are electrical disturbances of any kind in the air, a certain amount of the nitrogen and oxygen of the air combines, and the compounds thus formed are largely carried down into the soil by the rain. So here is, at any rate, one source of combined nitrogen for the use of vegetable life, and it is a source which is in more or less constant action.

THE GREAT MYSTERY OF THE NITROGEN THAT IS FOUND IN THE SOIL

But everyone who grows plants knows well that for practical purposes this source cannot be counted upon at all. If he trusts to it alone, and there are no compounds of nitrogen in the soil to start with, his plants will not grow at all, and this, of course, is true of all the crops upon which mankind lives. Or, rather, to be exact, we should say that the plant grows until it has used up the compounds of nitrogen contained in the seed from which it started. When that is done, the plant simply stops growing. So, plainly, there must be some other source of compounds of nitrogen besides what the rain washes down into the soil from the air.

We know this, also, because in some parts of the world there are enormous quantities of compounds of nitrogen in the soil—quantities which cannot possibly be accounted for in this way. *Something else* happens in the soil, by means of which the free nitrogen of the air is made to combine with other elements, and so turned into compounds of nitrogen upon which the green plant can live. We say that the nitrogen is somehow "fixed," and this question of the fixation of the atmospheric nitrogen is one in which all the students of the soil are now deeply interested, and some wonderful things have been discovered.

HOW THE MICROBE AND THE PLANT GO INTO PARTNERSHIP

There is a certain species of plants which has long been known to have a special power of growing and thriving even without a supply of those compounds of nitrogen which other plants need. The proper name for these is *leguminous* plants. They are so called because they form a thing called a legume; and we may know what that is because a pea-pod is a legume. Now, we find that the plants that produce pods like that—peas, beans, clovers, and vetches—behave as if they had the power of feeding on the nitrogen of the air. When we examine crops of this kind, we find that they contain far more nitrogen than can be accounted for unless the air has been drawn upon.

The men who began to study these plants found that they have tiny little swellings at various places on their roots, and that if they have not these swellings, they behave just like other plants, and cannot use the nitrogen of the air. Further, these swellings are only found on the roots of plants which have been infected by a little soil. If the plants are grown in sand, and no soil is allowed to get near them, no swellings appear on their roots, and they cannot grow unless compounds of nitrogen are supplied to them. There is, then, something in the soil which makes these swellings, and

which gives the plant the power of using the nitrogen of the air.

It was next found that these swellings are filled with microbes of a special kind. A sort of partnership springs up between the leguminous plant and the microbe, and this is only one instance of several that we know in which two different kinds of living things make an arrangement of this kind between themselves. The pea or bean, or whatever it is, supplies the microbes with sugar and starch, which microbes, not being green, cannot make for themselves, but which they find very useful. On the other hand, the microbes have the extraordinary power which no green plant has, of fixing the nitrogen of the air—that is to say, combining it with other elements. The compounds of nitrogen thus formed are handed over to the leguminous plant, which thus gets on just as well as if a rich supply of nitrates were being poured into the soil. So it was proved that microbes could fix nitrogen, but all attempts to make these microbes do the same for other kinds of plants, as, for instance, for wheat, failed completely. The arrangement will only work between these microbes and leguminous plants.

THE ENERGY THAT THE NITROGEN GIVES TO THE PLANT

Plainly, there was much more to be discovered, and that has now been done. The probability was that as there were microbes which could fix the nitrogen of the air, we should find other microbes, perhaps living free in the soil, which could also fix nitrogen, and could thus supply compounds of nitrogen for the life of green plants in general, trees and grasses, including cereals.

Now, there is a very important point which we must understand here. When we take nitrogen, and combine it with anything, power or energy is stored up, as we say; in other words, there is more energy in the compounds of nitrogen than there is in nitrogen itself. This energy is, of course, wanted and used by the green plant. But nothing comes from nothing. If we make compounds of nitrogen in the chemical laboratory, we know that, according to the quantity we make, so we must spend a certain quantity of electricity or heat; just as when compounds are naturally made in the air by electricity. Now, though life is a miracle and can do marvelous things, it can neither create nor destroy energy. It is a transformer, but not a creator. If a microbe makes a compound of nitrogen, it has to get from somewhere the power to do so, just as the chemist must when he does the same thing.

HOW THE MICROBES FEED THE PLANTS WITH NITROGEN COMPOUNDS

This means, indeed, that if the microbe is to make compounds of nitrogen, it must be supplied in its food with power which it can put into them. In the case of the microbes that live on the roots of leguminous plants, the power comes from those plants; that is part of the bargain between them, and it comes mainly in the form of things like sugar and starch. These things contain power, for they make us strong, and when they are supplied to the microbe, it puts the power of them into the compounds of nitrogen which it makes.

But, now, this is very serious, for the green plant requires nitrates, but the microbe requires the help of the green plant before it can make the nitrates. The first question we must ask is: Where does the energy come from, in the first place? There is no difficulty about the answer. The energy comes from the sun. It is the power of sunlight that is stored up in the sugar made by the plant. It is that power which the microbe takes and puts into the nitrates it makes. Now, in certain parts of the world, we find soils which contain a very huge quantity of nitrates. In Russia, in Manitoba, and in the Argentine, we find these rich soils, which are, of course, the joy of the farmer, and which grow the most magnificent wheat. Huge weights of nitrates are contained in every acre of these soils, and the soil is feet thick.

HOW THE POWER OF THE MICROBES COMES FIRST OF ALL FROM THE SUN

We are certain that these nitrogen compounds have been made by microbes; not the same as those which live on the roots of leguminous plants, but others. But the law that all power must be accounted for has to be reckoned with. Where has the power come from which the microbes have used? It has come from the sun by means of the green plant. The whole meaning and explanation of these wonderful soils is that, for a long time past, natural vegetation has

been growing upon them, catching the power from the sun and turning it into substances which fall into the soil, and feed the microbes, and so enable them to fix the nitrogen of the air. At an agricultural college, where men are teaching the world some of these great facts about the soil, they have carefully compared the soil on two pieces of land, side by side.

HOW THE EARTH SAVES UP THE RICHES OF THE SUN

One of these had been cultivated in the usual way, and each year the crops, whatever they were, had been taken away by man and used. The other piece of land was purposely left absolutely alone for a period of twenty-five years; it was allowed to run wild, until it became a bit of prairie land. The soil had been carefully examined before the experiment was begun, and the amount of nitrates it contained was known. At the end of twenty-five years it was found that the piece of land which had been cultivated contained no more nitrates than it did before, and that the piece which had run wild had been collecting huge quantities of nitrates. Year after year the green plant had been growing. Its starch and sugar, instead of being carried away by the harvest-maker, had fallen back to the soil, and had fed the microbes which fix nitrogen.

We have in fact discovered this very microbe, which is probably more important than all others in the world. It has rather a long name—*azotobacter*. This really means the bacterium, or microbe, that has to do with azote, and that is an old name for nitrogen. At this college they have lately examined soils from every part of the world, from Siberia, Australia, Canada, and so on, and everywhere, without exception, this microbe is found in the soil. It is a rather large, round microbe, but there is nothing about its appearance to tell us what its power is. If we could see into the heart of its life, we should find it to be a marvelous transformer of power.

A WONDERFUL MICROBE THAT IS LIKE A FURNACE AND BURNS UP SUGAR

It is like a furnace. It will burn up sugar and starch at a tremendous rate, and as it burns them up, it makes compounds of nitrogen. All over the world the growth of the green plant, upon which our lives depend, depends upon the exquisite balance of duty that obtains between the green plant, which can feed upon the carbon dioxide of the air but not on the nitrogen, and this microbe, which can feed on the nitrogen, if the green plant will supply it with the products of its feeding. Indeed, what it means is this: that the astonishing discovery made about leguminous plants really applies to all green plants. The leguminous plants have a special arrangement of their own, and the special microbes with which they are in partnership actually live inside their roots. But what is true of them is true in essentials of plants in general, though the azotobacter and its relatives find it equally convenient to live free in the soil instead of housing themselves in the green plant's roots.

It is a necessary condition for the existence of the azotobacter that the soil be not acid. Here and there we can find soils which have turned acid because something or other has made or put acid substances into them. In such soils the azotobacter cannot live, and, as a consequence, we find that these soils are infertile. Sometimes we are ourselves to blame for this, for we add to the soil various substances meant to do it good, which, nevertheless, are turned into acids by microbes.

THE MILLIONS OF USEFUL MICROBES THAT LIVE IN THE SOIL

Instead of doing the soil good by this treatment, we destroy the azotobacter, and then things will not grow in it. We are now beginning to get an idea of the complicated character of the soil. Words cannot describe how crowded it is with microbes of all kinds. The surface of the soil is always receiving additions of matter from previous life, leaves, and stalks, and so on. Then there are animal remains, and so on, added to it, not to mention the manures which are added to it on purpose. All these things, as they pass into the soil, are rapidly changed, and it is very easy to prove that these changes are all due to microbes. If we take some soil, and heat it so as to kill the microbes in it, all these changes stop; or if we add to the soil something which kills microbes, such as chloroform, then also these changes stop. That, of course, is the last thing that we wish to happen, for most of the changes which go on in the soil serve to prepare the food for the green plant. As we already know, the

very leaves which it sheds in the autumn are turned into new food for it in the spring, if the microbes are allowed to do their work.

Now, the ordinary chemistry of the soil is, of course, very important. We have already seen how tremendously important is the difference between an acid and an alkaline soil, and so it is very important that we shall add to the soil, in certain cases, certain chemical substances, such as nitrates and carbonates, and salts of ammonia. Often, however, we may do more harm than good if what we add upsets the balance of power amongst the microbes in the soil, and we are more and more learning that it is really the living microbes, and not the lifeless chemicals, that decide what the result shall be. And so the question arises whether our new knowledge of the soil may not help us to feed it with microbes of the kind we want, and so to get even more success than by feeding it with any chemicals at all.

LAZY MICROBES THAT WOULD NOT WORK FOR THEIR LIVING

Students of the subject began by getting hold of the microbes which they found on the roots of leguminous plants. They managed to grow them by themselves, just as the microbes of tuberculosis, and so forth, can be grown. And then they thought to apply these growths to the soil. They failed at first because the microbes, having been too well fed in the laboratory, had turned lazy, and simply would not work when they were put back into the soil. This is just one more instance of the universal truth which applies to every living thing and every part of it. Instead of having to work for their living, the microbes had been fed in little glass tubes with all sorts of nice things, which no doubt made them feel very fat, and plump, and comfortable, but made them useless, like all persons who are over-fed without having to work. However, that difficulty was got over; but even then it was found that either one kind or another of desirable microbes is *already* present everywhere in the soil.

A great many people believe that this feeding of the soil with living microbes is very useful; but, on the other hand, some people are not yet sure that this has really been proved. Time will show, and, at any rate, there is little doubt that if we cannot yet do what we desire, we shall be able to do so soon. Now, there is a most important matter which we must insist on. When we use up coal, or so-called mineral oil, we are really using up the great capital of wealth which has been accumulated—saved up from the sunlight of past ages, by the plants which were then alive.

HOW THE SUNSHINE OF THE PAST FEEDS THE FOOD-CROPS OF TO-DAY

And now we learn that in the new countries where we are growing crops to feed our ever-increasing millions, mankind is also living upon its capital. It is true that, in the great wheat-lands of Manitoba, for instance, the capital may be enormous, but it is not endless. The green fields of grain which cover such a great part of the earth to-day are, of course, using the sunlight of the present. We know that they could not grow without that. But if that were all they had to draw upon, they could not grow as they do. In the main, they are living upon the sunlight of the past, just as much as if we had to feed them upon coal, as we have to feed machines, which are not alive.

We have learned that the wealth of the soil upon which these plants grow has gathered there, and has been transformed by the azotobacter from the sugar and starch which past green plants have made from the sunlight. The soils which are wealthy now are the soils which have saved before now, like the soil of the land which was left alone for a quarter of a century at the college, and which became rich because men did not come and take away from it the wealth it made from year to year. People are looking to science to help them in this matter, that is, if they think about it at all.

SOMETHING THAT NEITHER NATURE NOR SCIENCE CAN DO

They think that when the coal is exhausted, or when the rich soils are exhausted, science will supply something else. Now, science can do wonderful things, but it cannot make something out of nothing, for the very good reason that not even Nature can make something out of nothing. Science may learn how to use to its best all the sunlight that falls upon the earth at the present. But when we have used up the sunlight of the past, as we are now doing, that is

Magnificent harvests of rich wheat are reaped in lands like Manitoba, where for centuries the soil lay unused.

all mankind will have to live upon, for we cannot borrow the sunlight of the future. These are great questions which thoughtful people must begin to think about unless posterity is to turn upon us, and call our age the age of blind waste.

After this we must go on to another part of the STORY OF THE EARTH. We have already a good idea of what the earth is, and we have studied some of the other worlds in space in order to learn more about the world we live on. We have learned also about the different kinds of elements that make up the earth, and the sun, and the stars, and the way in which those elements combine with each other. If we are to use big words, then we can say that we have studied geology and astronomy and chemistry and geography—not the geography which deals with frontiers and cities, but natural geography; and, lastly, we have even studied agriculture. There still remains a very important and very big study, the special name of which is physics—a name derived from the Greek word for Nature.

By physics we now mean the study of motion and heat, light, sound, and electricity. Of course, there is no real division between physics and chemistry, for instance, and we cannot understand the one without the other. Nature is not made in watertight compartments, though I am afraid we often talk and think as if she were, and as if our minds were. It is only for convenience, and because we cannot see everything at once, that we have to study one thing at a time. So next we shall go on to study motion, which is very much more interesting than perhaps we at present think.

THE NEXT PART OF THIS IS ON PAGE 3425.

The harvests in Canada are due to unused nitrates that have for centuries been accumulating in the **soil.**

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THINGS THAT CREEP & CRAWL

CONTINUED FROM 3307

IT is quite a good game to take a big bunch of keys and find the locks which all the keys fit. A key of itself is a useless bit of steel; but if it can be made to turn a lock it becomes an article of value. Naturalists find the same satisfaction, only on a larger scale, in fitting the little things of the animal world to their purposes in life. The keys were made to fit locks, and we, taking them as they come, have to find their places. Nature has a purpose for all her creatures, and it is for us to discover what that purpose is.

Some of Nature's creatures seem to have departed from the work for which we imagine them to have been created. We cannot think that flies and mosquitoes were made to inflict death upon men and beasts. They have departed from their original purpose, we think, just as men who thieve and kill other men have departed from their original purpose. On the other hand, we think that many things in the animal world are horrid, if not harmful, when really they are quite good friends to man. Most of us dislike creepy, wriggly things. Centipedes and spiders are among the things which fill many people with horror. Well, we must do with them as we have done with so many other things, examine the purpose which they serve in life, and realize the value of the part they play in the scheme of creation. First let us look at the centipedes—those long-bodied creatures with many legs which we find hiding in dark places, under stones, behind the bark of trees, and so on. When a centipede is discovered, a child generally feels as if it must crush the miserable thing.

To do so is foolish, for the centipede of this country does only good. It devours worms and insects, and is a check upon the too rapid increase of these. Many of the centipedes are blind. Those that have eyes can distinguish light from darkness, but little more. The antennæ supply the place of eyes. With these they feel their way along the ground, and discover things good for food. All the centipedes are flesh-eaters, hence the value in the garden of those that live in this country.

Northern centipedes are small compared with those that flourish in tropical lands. But we notice a peculiarity which distinguishes them in both temperate and tropical

regions. They all have many pairs of legs, but the number of pairs is always odd. Centipedes never have a dozen pairs or a score of pairs, or even a hundred pairs; they never have anything but odd numbers of pairs, whether it be fifteen or 121 pairs. Many people cannot tell the difference between a centipede and a millipede. There is a distinct difference. The centipede has one pair of legs to each segment of its body; the millipede has two pairs of legs to most of the segments of its body.

CENTIPEDES THAT EAT FLESH AND MILLIPEDES THAT EAT HERBS

The centipede is, as we have noted, a flesh-eater; the millipede lives only on vegetable food. A further distinction between the two may be noted in the shape, for whereas the body of the centipede is flattened, that of the millipede is shaped like a cylinder.

There are only two classes of centipedes, but the families included are numerous and they vary a good deal. The most famous are those which live in the hot countries of South America. These may well terrify people, for they grow to a length of twelve inches, and their bite is poisonous—not poisonous enough to kill a man, but bad enough to cause him pain. They live in hiding all through the day, but where human beings are, these great creatures creep into bedding, boots, gloves, and other clothing. A man goes to put on his boot, and finds a huge and savage centipede inside, which promptly bites him, and causes a bad swelling on his foot. Of course, creatures like these are much hated by men, but they do good work when left alone, devouring multitudes of cockroaches, beetles, and other unpleasant and injurious things.

A GIANT CENTIPEDE IN LONDON THAT FED UPON MICE

It is hard to say what they will not eat. They have been known to devour lizards bigger than themselves, and one kept at the London Zoo fed upon mice. Other centipedes may be found hiding near the seashore, while others live down in the soil like the worms upon which they live. To the earth-worms these centipedes must seem like terrible boa-constrictors, for the centipedes twine themselves round their victims while they eat them. The millipedes lack the poison duct which the centipedes have, and they possess only two pairs of jaws—half the number owned by the centipede. There are many sorts and sizes of them, but they are all harmless, unless they neglect their task of eating waste vegetation, and take to destroying useful plants. Two curious forms are the slug millipede, a creature with an enormous number of legs, which can roll itself up, and the pill millipede, which curls itself up into a tiny ball. For that reason it is sometimes confounded with a totally different little animal, the wood-louse. This belongs to the same family in Nature as the crab and the shrimp, being a crustacean, though it lives on land.

There are about 250 species of wood-lice, but the one which we may notice here is that one which, as soon as it is touched, converts itself into a little ball. We need not stay to discuss it here, but must just note in passing that the life-story of this humble little animal is one which causes wonder to learned men. Its habits are the source of much trouble to gardeners, especially English nursery gardeners, who grow things in hothouses for market.

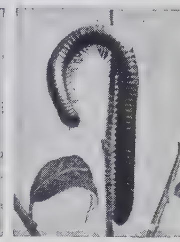
THE SERIOUS DAMAGE THAT THE WOOD-LOUSE DOES IN OUR GARDENS

The wood-louse is one of the worst foes of the man who grows costly maidenhair fern. The creature loves the tender shoots of the fern, and, taking itself and its family of little ones to the root of a plant, there it settles and secretly gnaws away at the stalks, sucking out the vital juice of the plant.

The damage that these crustaceans do in this way almost passes belief. They cannot always be killed by putting down stuff to destroy insects, for that would be too costly, and the same things which kill the wood-lice may at the same time kill the plants. The only thing to do seems to be to take each pot separately and shake out the wood-lice which it contains, and kill them. Think what a task this means when a nurseryman has thousands and thousands of pots. Before the pots can be cleared of their enemies, the latter may have done such harm as cannot be remedied. When the pots have been cleared of wood-lice, the nurserymen have to plan to keep them free. They tried to do this by raising on tins the wooden staging on which the pots stand. But, as soon as the tins

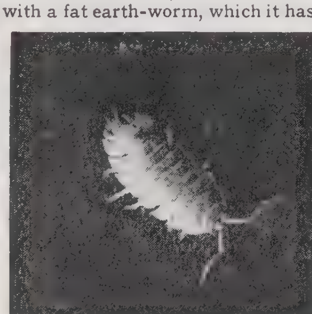
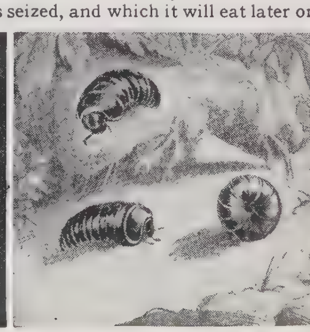
CENTIPEDES, MILLIPEDES, AND MITES



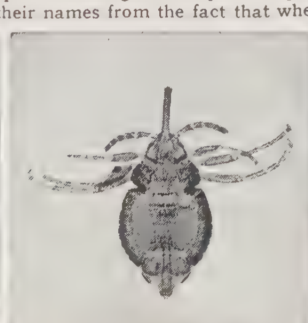
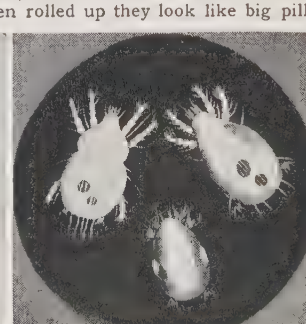


The centipede, whose name means " a hundred feet," and the millipede, meaning " a thousand feet," do not have a hundred and a thousand feet ; their names are exaggerations. But, as may be seen from these pictures, they have many feet. On the left is the common centipede, and on the right the common millipede. The middle picture is one of the giant centipedes of the tropics, which grow sometimes a foot in length, and their bite is as dangerous as the bite of a snake. These centipedes have been known to eat lizards and mice.

There is a long, worm-like centipede called the geophilus, a word that means " earth lover," because it lives entirely underground. It burrows like the earth-worm, and its food consists almost entirely of worms. Here we see the thin geophilus grappling with a fat earth-worm, which it has seized, and which it will eat later on.

We should not suppose that the wood-lice, those little creatures in gardens that curl up into a ball when touched, belonged to the same order as the crabs and lobsters. Yet this is so. The wood-lice are crustaceans, but they cannot all roll up ; and here we see, on the left, the giant wood-louse, and next to it the common wood-louse, neither of which rolls up. On the right is the pill millipede, that is often mistaken for the pill wood-louse. These creatures get their names from the fact that when rolled up they look like big pills.

The mites and ticks, which belong to the spider family, are very small, and these pictures of some of them are greatly magnified. They either ravage our fruits and flowers, like the currant-bud mites of the left-hand picture and the bulb mites on the right, or prey upon other creatures like the elephant-tick in the middle. Small insects, birds, and large animals, all have their pests in the form of mites and ticks that live upon them.

got rusty, the wood-lice crawled up and reached the pots. Then they did away with the tins and used glass jars as supports. But the wood-lice were not to be beaten even by this trick. They crawled up the wooden rafters of the conservatories, and then, curling up, let themselves drop into the pots below.

AN ENEMY OF THE GARDEN AND GREEN-HOUSE THAT MAY BECOME A FRIEND

At a single nursery where there are only fourteen greenhouses the wood-lice do damage amounting to $250 a year. Think, then, what damage they do altogether in the hundreds of nurseries of a bigger size, where ferns and other things that they like are grown. If denied ferns and other luxuries, the wood-louse can live extremely well on waste vegetation; and, by eating that, it is a benefactor to man.

We will leave them to their wickedness, and pass on to those interesting "insects," the spiders. As a matter of fact, they are not insects at all. Insects have only three pair of legs, but spiders have four pairs. They, with the millipedes and centipedes, the scorpions and mites, belong to a division of the animal world not included in the insect family. But, by whatever scientific name they may be called, every child knows a spider when he sees one.

Not every child, however, understands how marvelous is the skill, how extraordinary the character of the work done by the spider. It is the finest spinner in the world. It does not provide silk as good as that which comes from the silkworm, but it provides silk enough to make the most wonderful floating buildings in the world. The fineness and strength of a spider's web can never be matched by man.

THE SPIDER'S WONDERFUL WEB THAT IS STRONGER THAN A FRAME OF STEEL

What is the web, and how does the spider produce it? The web, before it leaves the spider, is a kind of gum. When it issues from the body of the spider, it takes the form of the finest silk, almost too thin to imagine, but stronger, in proportion to its thickness, than steel bars. The spider is generally provided with six tubes or spinnerets—sometimes there may be only four—placed in the lower part of its body. The silk does not come out in one strand. Each of the spinnerets has at least a hundred spinning tubes enclosed in it, from each of which a strand is drawn. In addition, many spiders possess a wonderful kind of sieve which grows in front of the spinnerets, and may have thousands instead of hundreds of spinning tubes. All the strands which come from all these tiny tubes combine to make the one thread of which the spider builds its web.

Every bit of garden web that we see may contain hundreds or even thousands of strands of silk, all woven together to make the finest natural rope in the world. A careful man has calculated that the threads of silk, as they issue from the thousands of holes in the sieves, are so fine that it would require millions of them to form a silk thread as thick as the hair of a man's beard. So small are the holes in the sieve through which the silk is drawn by some spiders, such as the orb weavers, or garden spiders, that a thousand of them are crowded together in the space covered by the point of a pin.

THE TERRIBLE FEMALE SPIDER THAT EATS HER HUSBAND

We may see the wonders of spider life for ourselves, for every garden has its spiders, and there is no web-spinning spider more interesting than the big fat queen of the cobwebs who dwells on bush and shrub in the garden. It depends on the weather how she will begin. We say "she" because the female spiders are the more important. The males are small, and are more often than not eaten up by the females after the wedding-day. In fact, they may be gobbled up even before the courtship is over. The lady spider is the most terrible sweetheart in the world. We shall leave out of account all male spiders, therefore, and watch a female. It depends, we agree, upon the weather how she will begin to build.

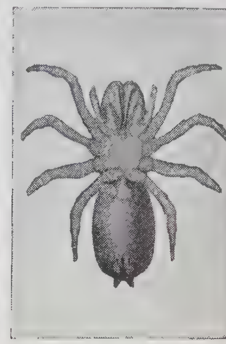
She starts by drawing forth a little quantity of silk. This she does by rapidly moving certain very sensitive wavy hairs upon her legs. She fastens the end to the place on which she is standing. Then she may have to run away to another point, to fix the other end of the web there, letting the silk trail out as she runs. But if there is a wind blowing she does as the smaller spiders do—lets her silk float free for the wind to carry it, and cause it to stick to some point where it can be made

LAND SPIDERS AND WATER SPIDERS

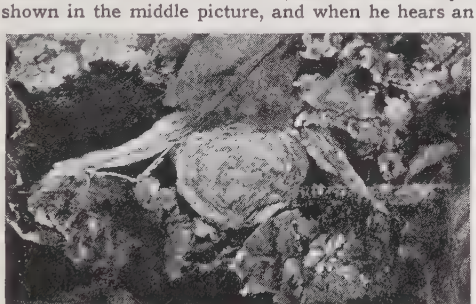
This is the female of the European garden spider. She is larger than the male, whom she often eats.

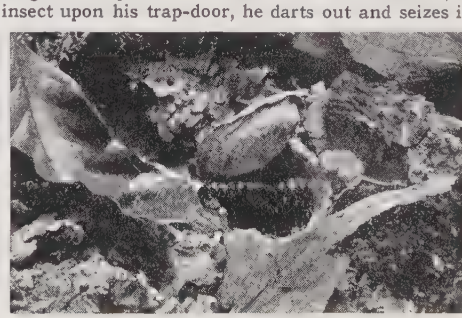
The common house spider does not build a beautiful geometrical web like the garden spider, but makes its web flat, as seen here. The web is only too well known in our houses, where the spider spins in dark corners.

The little harvest spider, so familiar in our fields, is not really a spider although it seems like one.

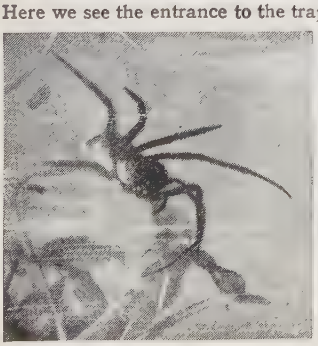


The trap-door spider, of which we see the upper side on the left, and the under side on the right, is a wonderful little miner. He burrows a shaft, or tunnel, a foot deep and an inch wide, and lines it with silk. Then he makes a little door to the tunnel, and fastens this by a hinge. The spider lives at the bottom of the shaft, as shown in the middle picture, and when he hears an insect upon his trap-door, he darts out and seizes it.

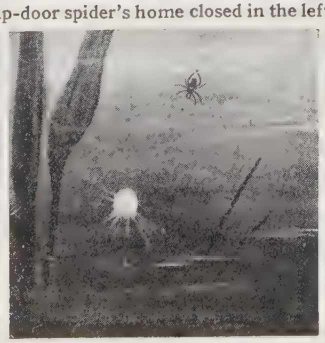




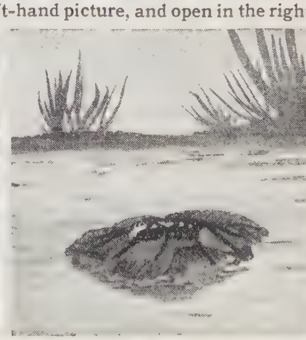
Here we see the entrance to the trap-door spider's home closed in the left-hand picture, and open in the right.



The water spider, shown here, is an interesting creature. Though born under water, it must breathe to live, and when it dives, it carries to its home a round bubble of air.



Here we see the water spider going down to its dome-shaped home of silk. The entrance being underneath, the spider can fill its nest with air, which is unable to escape.



This is the wonderful raft spider, that makes and floats upon a neat raft of leaves. When she sees a fly in the distance she leaves the raft and darts after it across the water.

The photographs on these pages are by Miss Cadly, F. P. Smith, D. English, S. Johnson, W. S. Berridge, W. P. Dando, P. Collins, and others.

fast. The web is sticky, and clings to whatever it touches. Now she runs rapidly over it, strengthening it as she goes with a line made of one or two strong strands. Then from this bridge she jumps from point to point, carrying her line with her until she has made the outer line of the web. Then she carries a thread around this line to an opposite point from where she started, so that it forms a cable, and repeats this process until two or three cables cross each other where the centre of the web will be. Now that she has her foundation, the next step is to build the lines that look like the spokes of a wheel, the radii we call them. To do this she starts from the centre of the web, and walking on one of the lines already made she carries a new line to another point on the outer line where she makes it fast. Back again she goes to the centre to start a new line, and so she works round in a circle until all the radii are built. Next she begins at the middle, and works out a spiral pattern of four or five rings, which fill out the centre of the web, and make it strong for her other work. The real business has yet to come. She now goes to the outer portion of the web, and, spinning all the time, works round and round, leaving a line of silk all the way, gradually drawing nearer and nearer the centre. This is the part which has to catch the flies, and if we look at it under a microscope, we shall see that the cross threads are covered with many thousands of little globules of a gummy substance, which the spider produces as she spins.

When the web is finished, the spider may need her own nest. She may decide not to remain in sight upon the web, lest insects seeing her should flee.

THE FIERCE POUNCE OF THE SPIDER THAT MEANS DEATH TO THE FLY

Generally speaking, the garden spider does run the risk, but others do not. These others make a little nest of silk hidden away—a hiding-place nest which generally has two openings, top and bottom. Threads lead from the web to this nest, and the moment any insect touches the web these threads vibrate and warn the spider. She does not ask the stranger to walk into her parlor. She springs out of hiding, rushes along the web with her clawed feet, pounces upon the insect, poisons it with one swift thrust of her weapon, then feasts upon its blood.

But suppose there should be more than one fly in the web at a time? The spider does not waste food. This is what a very big one in a garden did when a bluebottle-fly entered her nest while she was feeding upon another fly. With a buzz and a kicking and fluttering the bluebottle announced his arrival. He could not escape, for the net was too sticky. But there was just a chance that he would do some damage. The spider ran no risks. She uncoiled her legs from the fly upon which she was dining, and rushed like a flash across the web to the bluebottle. She grappled with him, and, with one movement, made it impossible for him to get away. She did not kill him, but seemed to stupefy him. For a few seconds she was busy with her claws round him, then suddenly the big bluebottle began to spin round and round on a thread of silk, her claws making him spin. And, lo, in a twinkling, he was completely wrapped in a sheet of silk.

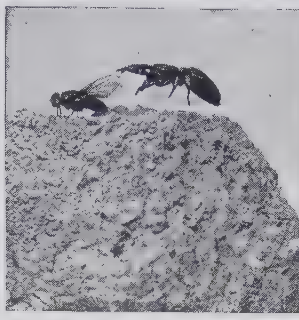
THE MYRIADS OF PESTS THAT THE SPIDERS DEVOUR

She had spun a cocoon over him, and she now hung him up in this cocoon in the web, and went calmly back to her meal, leaving him until she was ready to eat him at her leisure. It is of no use pretending that we love spiders, because we do not. We all shudder at their work, but at the same time we know that they are among the greatest friends we have in destroying, every summer, myriads of flies and harmful insects which, if left to multiply, might make our lives almost unbearable.

Leaving out of account the seeming cruelty of the spider's life, we can all admire the wonder of her building. That nest of hers is so strong that the wind will not blow it down, and heavy dew will glisten in its meshes without breaking a thread. The strength of each strand of silk in the web is wonderful, but the strength of the whole, thanks to the beautiful way in which it is made, can scarcely be believed. A scientist has tried to make it plain in this way.

Let us suppose, he says, that a child can lift a six-pound weight one foot high with 350 rubber bands, each band capable, when stretched, of pulling six pounds a distance of one foot. Let these bands be fastened to a wooden

SPIDERS AND SCORPIONS WITH THEIR PREY

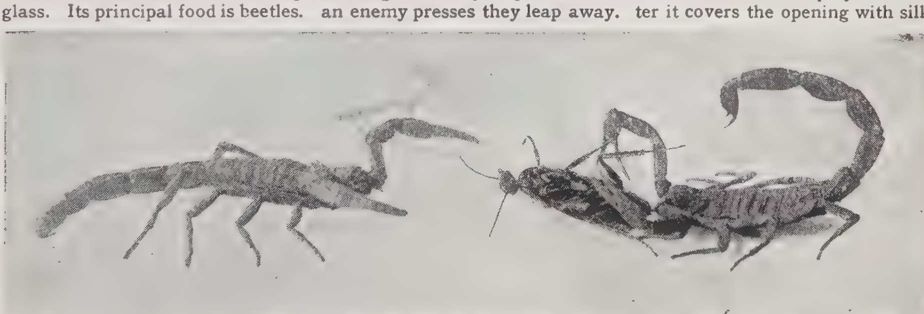




These photographs show three stages in the stalking of a fly by a marpessa spider, one of the largest of the northern jumping spiders, whose favorite haunt is the wooden palings of our gardens. The marpessa has keen sight, and is so cunning in hunting its prey that it hides behind every projection as it moves slowly towards its victim. At last, when it has come near enough, it gives one rapid jump, and the fly is caught.

The bird-eating spider of South America is as large as a mouse, and its furred feet enable it to walk up glass. Its principal food is beetles.

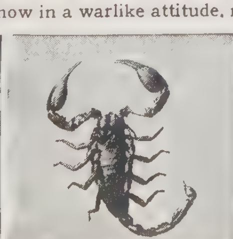
Wolf-spiders are hunters, not trappers, and their movements when hunting are very rapid. When an enemy presses they leap away.

The tarantula of South Europe is a large spider that digs a burrow, where it hides for its prey. In winter it covers the opening with silk.

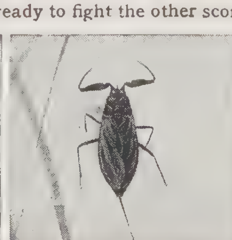


These are scorpions, and the one on the right has just seized a cockroach and killed it with one sting of its formidable tail. It is now in a warlike attitude, ready to fight the other scorpion in defence of its meal.

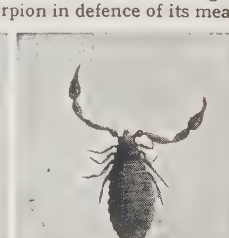
Here is another of the tarantulas. The ignorant peasants of Italy believe that its poisonous bite causes madness, which brings on a dancing frenzy.



The largest and most dangerous scorpions, like the buthus, are found in tropical Africa and in India. They are sometimes nine inches long.



The water scorpion is a creature that masquerades as a scorpion, but is not really a scorpion at all. Its tail is not a sting but only a breathing tube.



Another false scorpion is the chelifer, shown here. It is often found in old bee-hives, hen-roosts, and pigeon-houses, and under the bark of some trees.

platform, on which stand two horses, weighing 2,100 pounds, or nearly a ton.

THE MARVELOUS STRENGTH OF THE SPIDER'S TINY SILK THREADS

If, now, the child will set to work and stretch these rubber bands one by one, hooking each one up as it is stretched, in less than twenty minutes that child will have raised the pair of horses a distance of one foot. The elasticity of the rubber bands enables the child to divide the weight of the horses into 350 parts of six pounds each, and, by lifting all these separate pieces one foot at a time, the child can in the end easily raise this great weight. Each thread of the spider's web acts exactly like one of the rubber bands.

The garden spider makes her web in order that she may remain in comfort at home; but she has tiny relatives who use their silk for traveling. They send out their threads of silk as the garden spider sends out hers, the wind catches up the light strands of silk, and away they go up into the air, with the spider comfortably swinging at the end. In this way the spiders often travel great distances, for they have been met far out at sea. Many of the webs, becoming drenched with moisture, descend upon trees and hedges; some are blown across paths, and, wet and heavy, catch our faces as we walk. On bright autumn mornings, as we motor along the country roads, the face of the driver and the front of the car catch scores of these webs.

A SPIDER THAT DIGS A HOLE AND COVERS IT WITH A LID

The feats of our garden spider, wonderful as they are, seem commonplace when contrasted with the work of the trap-door spider. This creature is more common in hot countries than in others, but it exists in America, though it is not represented here by the largest species. By some naturalists it is called the mason spider, but its more common name is that which we give it here.

It makes a circular shaft in the earth about a foot deep, and from half an inch to one and a half inches wide. This shaft it first coats with a glazing material which makes it water-tight, and prevents particles of earth from falling in. Next, it lines the whole shaft with a covering of silk-like paper. Some of the tunnels have two tubes. The first tube descends in a straight line, and the second tube is made to branch off at a tangent, and to ascend, so that the two tubes are forked like a catapult. The door at the entrance to the shaft is, however, the greatest masterpiece of this spider's work. It is formed of layers of silk and earth, and exactly resembles its surroundings. The spider is so skilful in practising this deceit that it even glues pieces of earth and bits of dead leaves to the upper side of the door, so that it is quite impossible when the door is closed to discover it.

THE WONDERFUL DOOR OF THE SPIDER'S UNDERGROUND HOME

The hinge of the door is composed of strong silk, so that the trap can be pushed open quite easily from below. Should an enemy by some means find the trap-door, as it may by pursuing the spider to its home, the occupant, darting into the hole, pulls the door to with its claws and holds it tightly in position. It must be not uncommon for this to happen in some parts of the world, for there are spiders that are not content with one door; they have one door at the top of their shaft, and another, a smaller one, some few inches lower down.

The trap-door spider lives at the bottom of the tube. It must have very acute hearing, for it can detect the footfall of the lightest insect. Fancy our hearing an ant walking along the ground! The spider does, and out of its cell it dashes, seizes the insect, and drags it down into the shaft, where it sucks the juices which its body contains, then brings up the carcase and throws it well away from its home. Should any damage be done to its dwelling, the spider at once repairs it. By watching the spiders come out at night, naturalists have been able to discover these homes, and, to test the power of the spider, have removed the trap-door. It is proved that the spider can repair the damage five times, but no more. After the fifth destruction of its door, the spider gives up the struggle and goes away and hides, doubtless to await the time when it shall have accumulated a store of silk with which to renew work.

GREAT SPIDERS THAT CATCH BIRDS AND MICE IN THEIR WEBS

The strength of the webs woven by some of the tropical spiders far exceeds that of the webs which we know in this country. In the web of one a mouse

was caught. The spider increased its web, and actually succeeded, by adding new strands of considerable length, in raising the mouse four inches—in the same way, we may take it, that the child would raise the horses by means of elastic bands. We need not be surprised, therefore, that the webs of spiders like these are strong enough to catch birds. We must not, however, regard these as the real bird-catching spiders. That spider does not set snares to catch its prey. It makes a web, it is true, but this is in clefts of trees or between rocks, and here it hides all the day.

At night it comes forth, a fearful-looking monster, nearly as big as a rat. When its legs are outspread it occupies a surface nearly a foot in diameter. It can climb anywhere, for its feet are so padded with silk that it can easily run up a sheet of smooth glass set in an upright position. Its food consists for the most part of beetles and other insects, but it will eat any living thing which it can overpower. Thus when it finds a bird, the spider pounces on it, pins it down, and sucks its blood. This is the biggest of the spiders, and one of the most famous.

A very famous and dreadful spider is the tarantula, which was for a long time supposed to cause people the most extraordinary illness called "tarantism." Old-time doctors made a careful study of the matter, and decided that nothing but music could cure the sufferers; and books still exist advocating this mode of treatment, and actually giving the music to be played for the relief of the victim. The tarantula really does give a bad bite, but the idea of its causing dancing madness, as the supposed ailment was called, is all nonsense.

THE WOLF-SPIDER THAT WILL LAY DOWN HER LIFE FOR HER CHILDREN

The tarantula is only a big wolf-spider, and wolf-spiders of various sorts and sizes are common in parts of the United States; as, for example, in Southern California. They are the spiders which race about in the summer among stones and grass. They do not spin webs to catch their prey, but depend upon the speed with which they can run. Some of the wolf-spiders burrow tunnels in the earth, and some species raise curious turrets above the funnel entrance. The mother wolf-spider may often be seen carrying with her the little packet in which her eggs are deposited. She is a brave and good mother, and will fight to the death to protect her little ones and her eggs. When the little spiders are born, she carries them about on her back, the babies fastening themselves on with strands of silk until they are big enough to run about and look after themselves.

The wolf-spider can get over the ground at a great rate, but not so rapidly as the jumping spiders which we may find in our gardens on a hot day. For the hunters not only run, but make great leaps, and so catch the fly or other insect that they desire to have. It is quite exciting to see them spring down a high wall, for it would seem as though, having no wings, they must fall headlong to the bottom. But they know better than that; they attach themselves to the starting-point by a silken rope which runs out as long as they wish to descend, but stops when they reach the object for which they aimed. Then they can climb back by the aid of the rope, bearing their prey with them.

THE MARVELOUS BALLOON OF A SPIDER AT THE BOTTOM OF A POND

One of the most interesting spiders is the water-spider of Europe. The water-spider is, indeed, one of the marvels of the animal world. It is a creature which must breathe the air of the atmosphere to live, yet it is born under water, and passes all its days in or upon the water. It can run as easily and lightly upon the water as an ordinary creature can run on the land. Suddenly it dives into the water, and we see it darting down glistening with bubbles. And those bubbles explain the whole mystery. The water-spider is thickly covered with hairs and little bristles, and when it dives into the water, these carry air down with them, so that the skin of the spider is never wet.

But the most important thing is a big bubble of air which the female spider somehow manages to carry down secured between her hind legs. When she first goes down into the water she spins under the water a little dome-shaped cell of silk, with its opening lownwards. Having made this, she ascends to the top of the water, charges her whole body with air, and so arranges her hind legs that the big bubble of air cannot escape. This air she discharges into the nest which she has previously made. She makes

several journeys up to the top of the pond, and each time descends and acts as before, until the air fills the cell and forces out the water. Thus she has a little palace of silk and air in the water secure from all her enemies. Here she makes her home and lays her eggs.

A SPIDER THAT BUILDS A RAFT AND PUTS HER EGGS IN A BAG

Another happy European spider is the raft-spider. This makes a neat little raft of leaves, and on it floats about on the surface of the lake where she makes her home. If she sees a fly afar off, she darts from her raft and runs, light as air, upon the water. Should there be food down below, she trips nimbly down the stem of a plant growing in the water, and so reaches her meal. When she has laid her eggs she makes them up in a neat little silken bundle and carries this about with her. When the time draws near for the eggs to hatch, however, she fastens the cocoon to some plant growing near the edge of the water. Her cousins in this country run over the water to catch their prey, and dive under it to hide, but do not build rafts.

If we go out in the very early morning in summer, we may see the dew sparkling in the sunrise on countless webs spread over grass and shrubs. These are the work of our common grass-spiders, and are spread to catch unwary insects. If we look closely at them, we shall see that at one side of each web the spider has built a funnel, in which it lurks. When an insect is caught, the spider rushes from its den, runs across the web, and quickly ends the victim's struggles. There are many more spiders in the world which afford interesting study. Some are fearful things, which can change the color of their eyes at will, as the chameleon can change the color of its skin. Some run sideways like a crab; some build nests on coral, which keep out the water when the tide rises; and these spiders live on fish. There are spiders almost everywhere. Their very existence is a sure evidence of a great number of insects, and that is a good answer to the question as to what purpose they serve in life.

THE MITES THAT ARE FOUND ON ANIMALS AND MITES THAT WE FIND IN CHEESE

In the same class as the spiders are the mites and ticks, tiny things that live, for the most part, as parasites upon other little animals. Some are small enough to live upon the bodies of beetles, and some injure trees by making galls; some infest birds, and, if the poultry house is not kept clean, will make our chickens thin. If a pet dog or cat gets the mange, we know that some wretched little mites have managed to get into its skin. Other mites find their way into sugar, flour, cheese and other groceries, if the grocer does not keep his store quite clean, and sometimes the mites punish him for his lack of cleanliness by making his hands sore. Others again make the lives of sheep wretched. But the worst pest in this country among the mites and ticks is the cattle tick. This little animal lives on cattle, and is responsible for Texas cattle fever, a disease which has killed large numbers of cattle, and has caused great loss to farmers, particularly in the southern states. The tick is a native of the warm states, but is sometimes carried farther north. It carries the parasite, which causes the disease, from one animal to another in the same way that mosquitoes carry the parasites which cause malaria and yellow fever.

THE SAVAGE SCORPION'S STING THAT WILL MAKE A MAN ILL

In concluding, we turn from the smallest to the largest of the class to which this story is devoted, and we come at last to the scorpion. It is a hungry, savage creature, and serves a purpose by consuming an enormous number of harmful insects. The rest of its character is bad. Seemingly, the scorpion was a poisonous, bad-tempered creature from the first; and its manners, like its form, have remained unchanged. The worst scorpions live in the hottest parts of Africa and in India. These reach a length of eight or nine inches, and their sting can make even strong men very ill. The scorpion's body is half tail. That tail, as it swiftly moves along, it carries in the air, raised over its back. When it grasps anything, down comes the tail, and from the end a sting protrudes, and a poison is squirted into the wound caused by the sting. The poison paralyses the insect seized by the enemy.

Scorpions come out at night to search for food, and, though they live only in warm regions, they dislike the heat of the sun. Many scorpions are found in the southern states and in Mexico.

THE NEXT STORIES OF NATURE ARE ON PAGE 3445.

HANSEL AND GRETHEL

CONTINUED FROM 3283

ONCE upon a time, near the borders of a dense forest, there dwelt a poor man who earned his living by cutting wood.

On his way home through the wood, one day, he found a poor little girl who had been carried away by a vulture, and left high up on the branch of a tree to die. He took the little girl home to his wife, and they called her Grethel, and brought her up with their only son, Hansel. But his wife died, and the wood-cutter married again. After a little while the wood-cutter became very poor indeed, and could hardly earn enough money to buy bread.

One night as they were lying awake, weak and restless from hunger, Hansel and Grethel heard their stepmother say to their father:

"In a few days we shall all die of hunger. If we had only ourselves to keep we might manage to live. I know what we must do. Early to-morrow morning we will take the children far into the forest and leave them there."

"No, wife," said the man. "How can I have the heart to leave my children all alone in the forest for the wild beasts to kill and devour?"

But the hard-hearted woman talked and talked until the poor man agreed.

Hearing this dreadful plan, Grethel wept bitterly. But Hansel, who deeply loved her, comforted her.

"Do not cry, dear Grethel," he said; "I will find a way to get home safely."

He then got up quietly, crept out of the house, and filled his pockets with little white pebbles.

At sunrise their stepmother wakened Hansel and Grethel, saying, "Get up, children! We are going into the forest to gather wood," and she gave them two slices of bread for their dinner. Grethel carried both pieces in her apron, as Hansel's pockets were full of pebbles.

As they went along, Hansel kept looking back, until at last his stepmother asked him sharply why he kept lingering and looking behind.

"I can see my little white cat sitting on the roof, and I am sure she is crying for me," said Hansel.

"You stupid!" she replied. "It is only the sun shining on the chimney-pot."

When they reached the middle of the wood their stepmother said:

"Run about and collect some twigs, and we will make a bonfire to keep us warm."

And Hansel and Grethel soon had a blazing bonfire of brushwood. Tired with their long walk, they fell asleep; but when they woke up it was dark, and they were quite alone.

Grethel began to cry bitterly; but Hansel said:

"We shall be able to find our way home all right when the moon rises, because I dropped a white pebble every time I looked behind this morning."

When they reached home they were scolded by their stepmother for straying away; but their father was ever so pleased to see them come back safely.

Not long afterwards, however, the same poverty came upon them, and the stepmother persuaded her husband to take the children much farther into the wood. The children again overheard the cruel scheme; but Hansel was unable to get a pocketful of stones because his mother had locked the door. He bravely lingered behind, however, and dropped crumbs from his piece of bread all the way along.

"Why do you lag behind so, Hansel?" said the woman.

"I am looking at my little dove sitting on the roof wanting to say good-bye to me," replied Hansel.

"You silly boy!" said she. "It is only the morning sun shining on the housetop."

Their mother left them asleep just as before, and when Grethel said, "What are we to do, Hansel, dear, for the night is coming on and we are much farther in the forest than we were last?" Hansel replied, "Do not fear, dear Grethel; I have left all my bread in little crumbs on the wayside."

Grethel then dried her eyes and shared her piece of bread with Hansel. When the moon rose they started off; but, to their alarm, they found that there were no crumbs to be seen, as the birds had eaten them all up. They wandered about the forest all through the night and the next day, having only berries to eat; but they could not find their way home, so they laid themselves down and went to sleep.

About noon the next day they saw a lovely snow-white bird sitting on a branch, and singing so beautifully that they listened to it for a long while. When it had finished singing it flew slowly away, looking round at them as if inviting the children to follow. This Hansel and Grethel did, and after a little while the bird perched on the roof of a tiny house.

To their surprise they found that the walls of this little house were made of gingerbread, the roof of cake, and the windows of barley sugar.

"Oh! Something to eat at last!" cried the hungry Hansel. "Here is a lovely piece of barley sugar for you, Grethel." And the two children pulled pieces of gingerbread off the walls, and ate to their heart's content. Suddenly a voice came from within:

> "Munching, crunching, munching,
> Who is eating up my house?"

And the children answered:

> "The wind, the wind,
> 'Tis only the wind!"

and went on eating hungrily.

In a minute or two the door opened, and a little old woman hobbled out.

"Poor little children," said she. "How tired and hungry you look! Come in with me, and I will give you plenty to eat and drink."

The children followed her in, and had a meal of milk and pancakes, and apples and nuts. And then she put them into two pretty little beds, and they fell asleep and dreamed they were in heaven.

Now, the old woman was really a bad fairy, who built this gingerbread house to attract children, so that she could capture them and eat them. So when Hansel was asleep she took hold of him and quickly shut him up in an iron cage. She then shook Grethel, and said:

"Get up, lazy bones, and help me get water and cook some food, for I am going to fatten your brother and eat him."

After breakfast the old woman went out. Grethel immediately ran and told Hansel all the old woman had said.

"The old woman must be a bad fairy," said Hansel. "Search for her magic wand and pipe, and then help me out of this cage."

So Grethel found the wand and pipe, and they ran away together. After some time the old fairy came back, and was very angry to find that Hansel and Grethel had escaped her. So she put on her seven-leagued boots, and quickly caught up the children.

As soon as she saw the bad fairy, however, Grethel waved the magic wand, changed herself into a lake, and Hansel into a swan floating on it.

The fairy tried hard to entice the swan to the shore by offering him crumbs of bread and cake, but he would not move, so she gave it up and went

THE WITCH OF THE GINGERBREAD HOUSE

When Hansel and Grethel were lost in the forest they came upon a wonderful house made of gingerbread, with a roof of cake and windows of barley sugar. They were so hungry that they broke off a piece of barley sugar and began to eat it. Suddenly, to their amazement, an old woman appeared and invited them in.

home in disgust for the night. Grethel then changed Hansel and herself back into their proper forms, and on they went. Next day they perceived the fairy overtaking them again. This time Grethel changed herself into a rose in a prickly hedge, and Hansel sat on a mossy bank beside it and waited.

The fairy soon came up and mounted the bank to pick the rose which she knew must be Grethel. Hansel quickly put the pipe to his mouth and began to play. Now, as it was a fairy pipe, everyone who heard its music had to dance, even the old fairy, and there she capered and jigged, getting fixed firmly into the hedge, where the sharp thorns tore her clothes off and pricked her skin.

Grethel freed herself once more and they went on again, but became very weary, so Grethel decided to turn herself into a daisy while Hansel tried to find the way home alone. But Hansel got lost and did not return.

One day a shepherd spied the daisy, and picked it, saying: "I will take this little flower home with me; it is the prettiest daisy I have ever seen."

So he took it home and placed it in a box, and from that day everything flourished wonderfully in his house. All the work was done, the fire made and the water fetched, before he got up. He could not make this out, so he went to a wise woman, and she said:

"It must be witchcraft. Get up early to-morrow morning and throw a white cloth over anything that moves."

So he got up early and saw the box open and the daisy come out. He at once threw a white cloth over it, and the beautiful Grethel stood before him. She told him her troubles, and said:

"I will stay with you until Hansel comes back."

A long while passed and Hansel came back. Hansel and Grethel once more started for home, but getting tired they went to sleep in an old hollow tree.

In the morning when they awoke, the sun had risen high above the trees, and it was very hot. Little Hansel said:

"Sister, I am very thirsty; if I could find a brook I would go and drink, and fetch you some water too. Listen! I think I hear the sound of one."

Then Hansel rose up and took Grethel by the hand and went in search of the brook. But the fairy had found out all that had happened, and intended to do them harm; and when they had found a brook that ran sparkling over the pebbles, Hansel wanted to drink; but Grethel thought she heard the brook, as it babbled along, say: "Whoever drinks here will be turned into a tiger." Then she cried out:

"Ah, brother, do not drink, or you will be turned into a wild beast and tear me to pieces."

"I will wait," said Hansel, "for the next brook."

But when they came to the next, Grethel listened again, and thought she heard: "Whoever drinks here will become a wolf." Then she cried:

"Brother, brother, do not drink, or you will become a wolf and eat me!"

So he did not drink, but said:

"I shall wait for the next brook; there I must drink, say what you will, for I am so thirsty."

As they came to the third brook, Grethel listened, and heard: "Whoever drinks here will become a fawn."

"Ah, brother," said she, "do not drink, or you will be turned into a fawn and run away from me!"

But Hansel had already stooped down upon his knees, and the moment he put his lips into the water he was turned into a fawn.

Grethel wept bitterly over the poor creature, and the tears, too, rolled down his eyes as he laid himself beside her. Then she said:

"Rest in peace, dear fawn; I will never leave you."

So she took off her golden necklace, and put it round his neck, and plucked some rushes and plaited them into a soft string to fasten it, and led the poor little thing by her side farther into the wood.

After they had traveled a long way, they came at last to a little cottage; and Grethel, having looked in and seen that it was quite empty, thought to herself, "We can stay and live here." Then she went and gathered leaves and moss to make a soft bed for the fawn, and every morning she went out and plucked nuts, roots, and berries for herself, and sweet shrubs and tender grass for her companion; and it ate out of her hand, and was pleased, and played and frisked about her. In the evening, when Grethel was tired and had said her prayers, she laid her head upon the fawn for a pillow, and

slept. They lived thus a long while in the wood by themselves, till it chanced that the king of that country came to hold a great hunt there. And when the fawn heard all around the echoing of the horns, and the baying of the dogs, and the merry shouts of the huntsmen he wished very much to go to see what was going on.

"Ah, sister," said he, "let me go out into the wood. I can stay no longer!"

And he begged so long that at last she agreed to let him go.

"But," said she, "be sure to come to me in the evening. I shall shut up the door to keep out those wild huntsmen; and if you tap at it, and say, 'Sister, let me in,' I shall know you; but if you don't speak, I shall keep the door fast."

Then away sprang the fawn and frisked and bounded along in the open air. The king and his huntsmen saw the beautiful creature, and followed, but could not overtake him; for when they thought they were sure of their prize, he sprang over the bushes, and was out of sight in a moment.

As it grew dark he came running home to the hut, and tapped, and said: "Sister, sister, let me in." Then she opened the little door, and in he jumped, and slept soundly all night on his soft bed.

THEY WENT TO SLEEP IN AN OLD HOLLOW TREE

Next morning the hunt began again; and when he heard the huntsmen's horns, he said:

"Sister, open the door for me, I must go again."

Then she let him out, and said:

"Come back in the evening, and remember what you are to say."

When the king and the huntsmen saw the fawn with the golden collar again, they gave him chase; but he was too quick for them.

The chase lasted the whole day; but at last the huntsmen nearly surrounded him, and one of them wounded him in the foot, so that he became sadly lame and could hardly crawl home. The man who had wounded him followed close behind, and hid himself, so that he heard the little fawn say: "Sister, sister, let me in." Then the door opened, and soon shut again. The huntsman marked all well, and went to the king and told him what he had seen and heard. The king replied:

"To-morrow we shall have another chase."

Grethel was very much frightened when she saw that her dear little fawn was wounded; but she washed the blood away and put some healing herbs on it, and said:

"Now go to bed, dear fawn, and you will soon be well again."

The wound was so small that in the morning there was nothing to be seen of it, and when the horn blew, the little creature said:

"I can't stay here; I must go to look on. I will take care that none of them shall catch me."

But Grethel said: "I am sure they will kill you this time; I will not let you go."

"I shall die," answered he, "if you keep me here. When I hear the horns, I feel as if I could fly."

Then Grethel was forced to let him go; so she opened the door with a heavy heart, and he bounded out gaily into the wood.

When the king saw him, he said to his huntsmen:

"Now chase him all day long till you catch him; but let none of you do him any harm."

The sun set, however, without their being able to overtake him, and the king called away the huntsmen, and said to the one who had watched the fawn:

"Now come and show me the hut."

So they tapped the door, and said:

"Sister. sister, let me in."

Then the door opened, and the king went in, and there stood a maiden more lovely than any he had ever seen. Grethel was frightened to see that it was not her fawn but a king with a golden crown. However, he spoke kindly, and took her hand, and said:

"Will you come with me to my castle and be my wife?"

"Yes," said the maiden. "But if I come my fawn must go with me."

"Well," said the king, "he shall come and live with you, and want for nothing."

Just at that moment in sprang the little fawn, and his sister tied the string to his neck, and they left the hut.

Then the king took Grethel to his palace, and celebrated the marriage in great state. And she told the king all her story; and he sent for the fairy and punished her. And the fawn was changed into Hansel again, and he and his sister loved one another, and lived happily together all their days.

THE FABLES OF ÆSOP THE SLAVE

THE VILLAGER AND THE VIPER

ONE cold winter's day a villager found a viper under a hedge almost dead with cold. The man had pity on the poor creature, and so he brought it home and placed it on the rug in front of a warm fire. After it had been there some time the warmth revived it, and it at once began to hiss and to threaten to bite the children.

The villager heard his children crying out, and running in he caught up a stick and killed the viper, saying, "Is this the way you reward those who try to save your life?"

People who are not grateful for kindnesses are unlikely to receive any more.

THE FOX AND THE GOAT

A FOX one day happened to fall into a well, and could not get out again. Some hours afterwards a goat came to the place, and, wanting to drink, asked the fox if the water was good.

"It is so very good and sweet," said the fox, "that I have drunk so much that I am afraid I shall be ill."

Thereupon the goat, without any more hesitation, jumped into the well to drink the water. The fox at once sprang on her back, and so was able to leap out, leaving the poor goat in the well to get out as she could.

Be careful how you take the advice of people whom you do not know.

THE BOY WHO CRIED "WOLF!"

THERE was once a shepherd's boy who watched a flock of sheep in the fields. As a mere joke he would often shout out: "Wolf! Wolf!" This caused the men working in the neighboring fields to run to the rescue, but after being thus deceived two or three times, they decided to take no notice of his shouts.

Soon afterwards a wolf really came, and the shepherd's boy cried out in earnest. But no one took any notice of his shouts, and so his sheep were killed by the wolf.

If we tell untruths, no one will believe us, even when we speak the truth.

JUPITER AND THE ASS

AN ass which belonged to a gardener, and was tired of carrying a load of cabbages to market every day, prayed to the god Jupiter to give him a new master. Jupiter consented, and gave him a tilemaker, who sent him every day to market with a heavy load of tiles.

The poor donkey found that his work was harder than ever, so he again asked the god to give him a change. This time Jupiter gave him to a tanner, who treated him more hardly and cruelly than either of his former masters.

When it was too late the ass wished that he had stayed with his first master.

Be contented with your lot.

THE FOX AND THE LION

THE first time that a fox saw a lion and heard his terrible roar he was so frightened that he lay trembling on the ground and almost died with fear.

The next time he met the king of beasts he was not so frightened, but ventured to look timidly at him. The third time that the two animals met the fox had lost all his fear, and came coolly up to the lion and entered into conversation with him as if he had been an old friend.

Familiarity breeds contempt.

THE PASSING OF KING ARTHUR

AND THE BREAK-UP OF THE TABLE ROUND

MANY other stories of King Arthur's knights are there, and these you may read in books; but here we have room left only to tell the end of the Round Table. For this gracious Order of Chivalry, which was like a parliament ruling Britain in a goodly manner, so that no man dare play the tyrant and none oppress the poor and the weak, came to an end, and the unwitting cause of it was Queen Guinevere, the loveliest lady in Christendom.

This beautiful lady could not keep her thoughts from dwelling much on king's will—was tried for treason, and was ordered to be burned as a traitor to the king.

As she stood bound to the stake, and the flames began to rise around her, Lancelot rode up, slew those about her and before her, and carried her off. He had saved her, but she could not be his, for Lancelot loved honor. So he took her to an abbey, where she gave up all her life to prayer and holiness, and there the greatest knight of Christendom parted from the lovely queen. After that Lancelot retired to Gaul.

QUEEN GUINEVERE IN THE ABBEY GARDEN AT MALMESBURY

This picture is reproduced by permission of the artist, Mrs. Mary F. Raphael, who also painted the beautiful picture given on page 696.

Sir Lancelot of the Lake, who was the handsomest, the strongest, and the most courteous of all King Arthur's knights, and Arthur loved him as a brother. So great was Arthur's love that when evil men, who hated Lancelot, tried to make him think that Guinevere loved the knight more than the king, Arthur was very wroth. But these evil men bided their hour, and one day, when Lancelot was alone with the queen, they came in a great number and made an uproar at the door of the queen's chamber, crying "Treason! Treason!" So Lancelot, after slaying many of them, had to flee, and Guinevere—against the

Then the brother of one whom Lancelot had slain forced the heart-broken Arthur against his will to make war on Lancelot. They fought in Gaul, and Lancelot gave orders that none should hurt the king, and as often as he saw Arthur dismounted he himself went to his rescue. Many times in the midst of this fierce battle the two great men looked into each other's eyes, and exchanged words of love and courtesy.

Afterwards Arthur returned to Britain, for his kingdom was in an evil state, and there was a great war in the West. The story of Lancelot and the queen had been a poison in the land,

and men forgot honor and courtesy, and had become like beasts. It seemed as if all the king's noble work was undone. The ideals of kindness and chivalry which had given peace, glory, and virtue to the land, were now mocked at as make-believes and foolish notions. The strong trampled the weak. Few cared about honor. There was none to help the weak and oppressed. Sad and heart-broken was King Arthur, who had lost his queen, his favorite knight, and now his kingdom; but he fought in the West boldly for Christ and righteousness, as one who would never surrender; and there was he wounded to the death.

Now, when he was wounded, he called upon Sir Bedivere to carry him to a little church by the seashore; and Sir Bedivere wept, but Arthur comforted him. Then said the king:

"Take now my sword, Excalibur, and hasten thee to the side of the water, and fling it into the deep." And Sir Bedivere went away. But the beauty and fame of the sword tempted him, so that he hid it, and returned to the king with a lie. But the king knew that he lied, and sent him a second time. Yet a second time did Sir Bedivere lie, and the king sent him a third time. Then Sir Bedivere returned, and the king asked:

"What sawest thou?"

"I saw," answered Sir Bedivere, "a hand rise from the water, and as the sword hurtled towards the waves the hand caught it by the hilt, and brandished it thrice in the air, and afterwards drew it down under the water."

"It is well," said the king.

Then he commanded Bedivere to carry him to the water's edge, "Where the lapping waves floated many an empty helmet and the fitful moonlight fell on the upturned faces of the dead."

And as they reached the shore a great barge came to them, wherein were three queens, all in black with crowns upon their heads. And the queens received the king into the barge, and one took his head upon her lap, and another chafed his hands, and the third bowed at his feet, while the barge drew slowly away across the darkening sea.

And the last words of King Arthur came across the waters to Sir Bedivere, as he was kneeling on the shore: "Pray for me."

HIS MASTER'S SON

LONG ago, when the famous Mahratta warriors of India were at war, there rode at the head of the army a splendid elephant, carrying their standard. The man who looked after the animal—its mahout, as such men are named—had made the elephant very fond of him.

When the battle began, the mahout gave the animal the word to halt, and the elephant stayed. Soon after that its master was killed, and as the shock of battle closed round it, the Mahrattas were forced back, defeated and scattered. But nothing could move the elephant; he stood still, waiting for his master's voice. The standard the animal carried still fluttered defiantly in the breeze, and the Mahratta soldiers, looking back from their flight, saw it, and, thinking that some part of their army must be still undefeated, fighting round the flag, they gathered their shattered forces and returned to the attack.

Their impetuous assault was unexpected, and was delivered with such spirit that this time they swept the enemy from the field, winning a great victory. Then they turned back to the standard-bearer, and sought to lead him away. But he would not move. He still waited for the voice of his master. Other mahouts tried to coax him; they even beat him. It was of no use; he would not leave the spot at which his master had told him to halt.

The strange event was reported to the ruler, and he remembered that the dead driver had a little son for whom the elephant had a great affection. The little boy was at home, a hundred miles away, but the ruler sent horsemen to bring him. They rode as fast as they could travel, and at last got back. With them came a little round-eyed, lisping child.

When the elephant saw the boy it gave a blast of joy, and, with its standard still flying, its shattered battle-harness clanging at its sides, it slowly followed him. Three days and three nights it had stood where its master left it. But in the little boy it recognized a new master, and so could obey his orders to leave the scene of the victory won by its faithfulness.

LEGENDS OF THE STARS

In the early ages shepherds tending their sheep and goats, huntsmen pursuing the hare, the bear, the wolf, and the lion, sailors on the wide sea meeting whales and sea monsters, or seeking fish, fancied that they could make out pictures in the groups of stars. They invented stories about them and about wonderfully strong and beautiful beings, gods and goddesses, who were more than human, living high up there in the sky. Here are a few of these legends telling of the star-pictures beginning on page 2639.

AN INDIAN LEGEND

According to an Indian legend from California, the sun, moon, and stars are one big family. The sun is the great chief and ruler of the heavens; the moon is his wife, and the stars are his children, whom he has to eat to keep himself alive when he can catch them. But when he is up in the morning, they flee out of his sight as fast as they can, and dare not appear again until he goes into his hole in the west. He crawls along this hole till he comes to his narrow bed in the middle of the earth. This is so small that it does not give him room to turn round; so when he wakes up next day he has to creep out to the east. Then his wife, the moon, takes her rest.

Every month she grieves when he eats up some of the stars, and puts black over her gentle face to show her sorrow. This gradually wears off, till by the end of the month her face is bright again. The stars are happy with their mother, the moon, and sing and dance as she passes among them. After a time other star children disappear, and she has to put on mourning again for them.

ORION, THE BELTED GIANT

Orion was a giant who wanted to marry Hero, daughter of Ænopion, King of Chios; but this king, who took a dislike to the suitor because of his great height, thinking to rid himself of a troublesome person, consented to the marriage only on condition that Orion should free the island of Chios from the beasts that raged there. This he did, but King Ænopion failed to keep his promise, and had him blinded. Then Orion was directed by a blacksmith, whom he carried on his back, to the best spot to face the rising sun. Gazing at it, Orion recovered his sight.

According to one legend, Diana, through jealousy, slew him with her arrows; according to another, his death was due to the bite of a scorpion which rose from the ground to punish him for boasting of his prowess as a hunter. He was carried to the heavens, and there shines as a constellation of seventeen stars, with a glittering belt round his waist and his dog Sirius near him. He is found near the feet of the Bull, and is sometimes shown with a club or a sword in his hand, and bearing a shield. One of the stories about him is that he piled up a bank on the coast of Sicily to keep out the sea; another, that he was a worker in iron, and made a palace for Vulcan, underground.

THE GREAT DOG

Near Orion, between the Hare and the Milky Way, as far south as we in the Northern Hemisphere can see, lies the Great Dog of Orion, containing one very brilliant star called Sirius. It used to be regarded as a warning by the Egyptians, just as a good watch-dog warns a house of coming danger. The dog in the sky could not bark, but its bright light let the Egyptians know of any harmful event about to happen.

When they saw the star in the early morning they knew the Nile would soon overflow. So one name they gave it was the Nile Star. Of course, they knew nothing of the real sources of the Nile then, because no one had found them out. Sometimes, to show what it was necessary to do on its appearance, they pictured the dog as a man with a dog's head, a stew-pot in his arms, a feather under one arm, wings to his feet, and leaving behind him a duck and a tortoise. The Greeks and Romans associated the Dog star with the heat of summer, and said that it burned up the fields and killed the bees. We still talk of the dog days in the hottest season.

A FAMILY GROUP

There are four constellations in the sky standing for quite a family group. Cassiopeia, the mother; Cepheus, the father; Andromeda, the daughter; and Perseus, the son-in-law, with, a little further off, Pegasus, his winged horse. Cassiopeia foolishly declared herself to be more beautiful than the

Nereides, and the angry nymphs, in revenge, persuaded Neptune to send a sea-monster to trouble Æthiopia, or Topa, where Cassiopeia lived, for she had married King Cepheus of that country. The story of Andromeda's exposure to the monster, and her rescue by Perseus is told elsewhere. Cepheus, the husband of Cassiopeia, sailed with the famous Argonauts.

Cassiopeia was pictured by the ancients in a southern constellation of thirteen stars, seated on her throne, and holding a palm-leaf in her hand. Cepheus is near here. Cassiopeia, as the constellation is called, can be recognized very easily in the sky in the form of an "m," or, as some see it better, a "w."

THE GREAT BEAR

LOOKING at this group of stars, so easily observed, for they never set in the Northern Hemisphere, people fancied they saw in them different objects. So the Greeks said: "It is a chariot"; the ancient Gauls called it "Arthur's Chariot"; the Americans, "The Dipper"; the English, "Charles's Wain" or "The Great Bear." There are two bears really, a Great Bear, or Ursa Major, and a Little Bear, or Ursa Minor. This is the legend of how they came there.

Jupiter and Calisto had a son named Arcas. Juno, who was jealous of Calisto, changed her into a bear, and her son by mischance was on the point of killing her. Jupiter, recognizing her danger from huntsmen, changed her into a constellation. Arcas' kingdom was Arcadia, a happy land, where people were taught by their king to till the ground and spin wool. One day while hunting, he met a beautiful wood-nymph in trouble because the tree over which she watched was in danger from a river in flood. Arcas saved the tree by turning aside the current; then he married the nymph, and when he died left his kingdom to his three sons. Jupiter at his death turned him into a bear like his mother, so that he has since kept her company as a constellation.

THE PLEIADES

THESE seven stars were associated with seven beautiful sisters, daughters of Atlas, and named Electra, Maia, Alcyone, Taycete, Celæno, Merope and Sterope. They all married gods, except Merope, whose light is less bright because she was wedded to a mortal, Sisyphus, King of Corinth. Electra's light also diminished through grief after the fall of Troy, which her son Dardanus had founded.

The word Pleiades comes from a Greek word meaning "to sail," because this constellation shines well in spring, at a good time for sailors to start on a voyage. Because, too, of their association with Ver, the spring, these stars are also called the Virgiliæ. From the earliest times, festivals and seasons were connected with the rising of the Pleiades.

The story runs that, in Bœotia, the giant Orion went in pursuit of the seven sisters, but they prayed to be saved from him, and they were changed into the form of doves. Now they are ever at a safe distance from him in the skies, at the back of the Bull, and behind its protecting horns, where Orion cannot trouble them.

HERCULES WITH HIS CLUB

THE celebrated hero Hercules, son of Jupiter, was, of course, bound to be enthroned among the gods in the skies, so that the Greeks gave him a place of honor, with his club in his right hand, an apple-branch in his left, in memory of the apples of the Hesperides, and in a kneeling position, with the lyre near his feet.

The legend is that Hercules was fighting one day with stones, but had used them all up. Then Jupiter, seeing the danger of his son, rained down a shower of round stones. These Hercules bent down to pick up, and throw at his enemies, and thus overcame them. This is why he is shown kneeling.

Many are the stories of his prowess and marvelous physical strength, but the most wonderful were his twelve labors, on the performance of which the Delphic oracle promised him immortality. These included slaying the Nemean lion, the Hydra, or water-snake, and the monster birds; capturing a stag with hoofs of bronze and antlers of gold, the boar of Erymanthus, the mad Cretan bull, the mares of Diomedes, Geryon's oxen, and Cerberus, the dog of hell; securing Hippolyte's girdle and the golden apples of the Hesperides. By his own will his body was burned on a pyre, and his spirit passed away in a cloud to Olympus, where he married the goddess Hebe, and became immortal.

THE NEXT STORIES ARE ON PAGE 3497.

READING

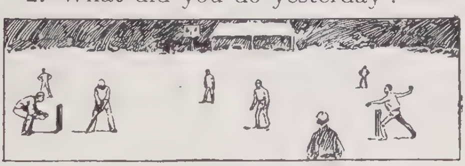
SOME MORE ABOUT VERBS

CONTINUED FROM 3336

NOW do you think you will always know a VERB when you see one? Verbs are among the most important words in the world, so we must always be very polite to them, pay them a good deal of attention, and never let them pass without noticing them. They are something like kings among words, because most of the other words are less important, and the verbs rule over them.

Now I want to ask you three questions, which you must answer.

1. What did you do yesterday?

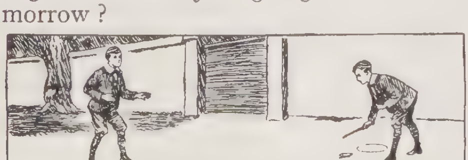


WE PLAYED CRICKET.

2. What are you doing to-day?

WE ARE PLAYING BALL.

3. What are you going to do to-morrow?



WE SHALL PLAY TIP-CAT.

The first answer tells me something that you did yesterday; it is now PAST and gone, and you are no longer playing cricket. You have had supper, and been to bed, and had breakfast since. The second answer tells me what you are doing now at the PRESENT moment; you are so busy at playing ball that you can hardly stop to speak to me. And the third answer tells me what you are going to do to-morrow: you are looking forward to it, it is still in the FUTURE, and you are wishing that to-day would come to an end and to-morrow begin, so that you might start your game.

So you see there are three sorts of TIME: (1) The time that is gone, PAST time; (2) the time that is here now, this very second, PRESENT time; (3) the time that is coming, but has not yet come, FUTURE time. Every verb can be used in all these three ways. Let us try some more verbs and see.

If it was dinner-time, and you were busy eating your dinner, you could say: "I HAD a good breakfast this morning; I AM HAVING a good dinner now; I SHALL HAVE a good tea this evening."

And if a friend saw you in the street, but just as he was running up to you a big wagon came between you so that you could not see each other, you could say: "He SAW me just then; he SEES me not now; he WILL SEE me again in a minute."

Take any verb you like (such as WALK, LOVE, CALL) and try it for yourselves; turn it into each one of these three times. But there is one more thing to remember; we do not talk about the TIMES of a verb, but about the TENSES of a verb. TENSE just means TIME, but it sounds more learned. And so you must call I RUN the present TENSE; I RAN the past TENSE; and I WILL RUN, the future TENSE of the verb TO RUN.

Here are some verses about past, present, and future for you to learn:

Don't fret about the thing that's past,
And be no longer sad;
Your troubles cannot always last,
Nor times be always bad.

Don't waste your time and idly dream
About some future fight:
But like a man that rows up-stream,
Pull hard with all your might.

So do your duty here and now,
The present is your own;
And what you've done, and when and how,
The future will make known.

We have seen that there are different TIMES of doing a thing—Past, Present, Future: and so we have learned about the TENSES of a verb. I think that by this time you see quite clearly the difference between having learned your lessons already and intending to learn them at the last moment just before going to school. The one is PAST, the other is FUTURE; while if you are learning them now, that is PRESENT.

But there is another great difference that we all feel as we grow up, and that is the difference between doing something ourselves and having something done to us. Cruel boys like teasing cats and dogs, but they do not like to be teased themselves. It is very nice from our point of view to catch fish, but it is not very nice for the fish to be caught. Many of us enjoy kicking a football about, but if the football could feel, I do not suppose that it would enjoy being kicked.

Now, when a boy kicks a football, he says, "I KICK the ball," but if the football could speak, it would say, "I AM KICKED." And when the fisherman feels a fish on the end of his line, he can say, "I CATCH a fish," but the poor fish calls out to his father and mother, "Oh, dear, I AM CAUGHT." And if ever you pull poor Pussy's tail, you could say, "I PULL her tail," but she very likely says, "My tail IS PULLED by this naughty boy; I must scratch him to make him polite."

Do you see the difference? I KICK, I CATCH, I PULL, mean that the person is doing something; while I AM KICKED, I AM CAUGHT, MY TAIL IS PULLED, mean that the person or animal or thing is having something done to him or it. Here are some more sentences to think out:

The boy WHIPS his top.
The boy is WHIPPED by his father.
Baby NURSES her doll.
Baby is NURSED by her mother.
Tom FEEDS the dog.
The dog IS FED by Tom.

It is always quite easy to see the difference between these two kinds of sentences. Just ask yourself, "Is the person doing something, or having something done to him?" If he is doing something, then he is ACTIVE (which just means "doing"); if he is having something done to him, then he is suffering something, or, to use another word, he is PASSIVE (which just means "suffering"). So when we come across a verb that tells us the person is doing something, we say that this verb is in the ACTIVE VOICE; and when we come to a verb that tells us the person is suffering something or having something done to him, or is affected by some action, we say it is in the PASSIVE VOICE. The word VOICE is a very funny one to use here, isn't it? It generally means the tone in which a person speaks (as "This giant has a squeaky voice"), but we must remember that verbs have voices.

"There's all the difference in the world,
As clearly I can see,
Between doing a thing to somebody else
And having it done to me.
It's very great fun other people to tease,
Though sometimes it causes them pain;
But when they pay me back, all the jolliness flees,
I humbly beg pardon, go down on my knees,
And stammer, 'Oh, please, let me off this once, *please*,
And I never will do it again.'"

TOM AND NORA LEARN TO WRITE WITH INK

BEFORE the next writing lesson, Tom and Nora were taken by their mother to buy two little glass inkwells, two pens, and some blotting paper. Then they set about making pen-wipers from a piece of black cloth, cutting out four rounds for each, scalloping the edges, and sewing them together in the middle with pearl buttons.

" Now some nibs from the inkstand drawer, and we have everything ready for writing with pen and ink," said the children's mother. " You notice the inkwells are only three-quarters full, because ink is a nasty thing to spill for it stains so. In putting the pen into it, we take care not to dash the pen against the bottom of the well, but just dip it in so that the ink covers the nib. Watch how I do it, and see how, when not using the pen, I rest it on the rim of the well, so that the nib is out of the ink. Remember there is ink in the nib, and therefore the pen cannot be flourished about like a pencil."

Tom and Nora looked carefully at the penciled copy their mother had already set, and then started to write each of the following words :

H was quite ready for it, and did not do anything really new.

" G does not manage to join e at all," said Tom, as he looked at the word Get.

" When you can write quite fast, you will want to join every letter," said his mother. " But that will not do yet, for we have to walk before we can run."

Tom wanted very much to find a way to make G join on, and he tried several ways on a piece of scribbling paper ; but every one looked so ugly or awkward that at last his mother came to his assistance.

" Do you remember," she said, " there is another way of making capital G ? This is it, and Tom will have no difficulty in joining this G to e. You see it has a tail like small g, and joins on like it."

G

Nora had noticed that she and Tom were writing the capitals in the order of the alphabet, so she was not surprised when the first of the new words to be written was Kate, the name of the nursemaid.

K, L, M and N were quite easy to join, and Tom and Nora had worked so hard with their new pens, and only

All Beck Can Dog Egg

Fat Get Hope Isle Jack

Kate Lift Meal Nail

While these words were being copied, the mother pointed out how, when it could be easily done, the capital letter joined on to the small letter to follow. For instance, A, C, E, H and J joined quite comfortably. D was more difficult, because it joined on to o in dog with a long curve, much longer than the one which ended the single capital letter. Nora turned up her old copies of D to compare the two.

H had also a long loop to make to get to the top of o, but then, as Tom said, made one smudge between them, that their mother said they should rest and watch her make M and N in another way, as she had once promised. This is how she wrote these letters :

M N

' This way of making M and N is not so common as the way you already know, and the letters are unlike small m and n," she remarked.

HOW NUMBERS ARE DIVIDED

SUPPOSE we have 28 marbles, which we wish to divide among 7 boys. How many marbles shall we be able to give to each boy?

Clearly, if we give each boy one marble, we use 7 of the marbles. If we give each boy a second marble, we use another 7, which makes *two* sevens. We see, then, that the number of marbles each boy will get simply depends on *the number of sevens in* 28. Now, our multiplication table tells us that *four* sevens make 28. Thus each boy will have 4 marbles.

Now, this process of dividing 28 marbles among 7 boys is evidently the same thing as finding out how many times we can take away 7 from 28. Thus, division is repeated subtraction.

We must next notice that, if we had been told that 28 marbles are divided among a certain number of boys, and each boy got 4 marbles, then we can find out the number of boys. For we have only to think how many 4's make 28. We know that *seven* 4's make 28, so there must be 7 boys.

Either of the results we have just obtained could be got by actually counting out the 28 marbles. We used the multiplication table, but the table itself was formed by counting. In a similar way, we will now try to divide 52 pencils into 4 equal groups.

Suppose we have the pencils arranged in tens. There will be 5 tens, and 2 odd pencils. Now, to divide these into 4 groups, we can begin putting one of the tens into each group. This will leave us with a bundle of ten and the two odd pencils. If we separate this remaining bundle, we shall have twelve loose pencils. We have now only to count out these pencils into the four groups: we use 4 every time we put a pencil to each group, and since there are *three* 4's in the 12 pencils, we shall be able to put 3 more pencils to each group. Each group now consists of a bundle of ten, and three odd pencils—that is, 13 pencils, or 52 divided by 4 gives 13.

We have divided 28 into 4 equal parts, and 52 into 4 equal parts. Let us now examine the process carefully.

In the case of the 52 pencils we had 5 bundles of 10—that is, there were *more* tens than the number of groups. We were therefore able to put a ten into each group, *without breaking the bundles*. Having done this, we had not enough bundles left to put another into each group, so we had to break the remaining bundle and proceed to deal *ones* into each group.

In the case of the 28 marbles there were not enough tens for us to begin by putting a ten into each group. We had, therefore, to begin at once dealing *ones* into each group.

This same idea has to be carried out in the division of any other number. Suppose the number 956 is to be divided by 4. We first divide the hundreds into 4 groups. The number contains 9 hundreds; we can therefore put 2 hundreds into each group. We now have 1 hundred left over. This hundred consists, we know, of 10 tens. Putting these with the other 5 tens, we have 15 tens altogether. We next proceed to divide these tens among the 4 groups. There will be 3 tens for each group, and 3 other tens will be left over. Finally, we take these 3 remaining tens and separate them into thirty units. These, with the 6 units of our number 956, make 36 units altogether. Then, dividing 36 units into 4 groups, we get 9 units for each group. Thus, each group now contains 2 hundreds, 3 tens, 9 units—that is, 956 divided by 4 gives 239.

$$\begin{array}{r} 4\overline{)956} \\ \hline 239 \end{array}$$

To do our work on paper, we shall arrange it like this. Write the 4, which is called the *divisor*, in front of the number to be divided, 956 (this number is called the *dividend*), and separate it from the 956 by a bracket. Then say, 4 into 9, 2, and 1 over. Put down 2 in the hundred's place—that is, under the 9.

Remember that the "1 over" is 1 hundred, and we have only to put this 1 before the 5 to know that there are now 15 tens. Next, say 4 into 15, 3, and 3 over. Put down 3 under the 5. The "3 over" are 3 tens, which, written before the 6 units, make 36 units. Finally, 4 into 36, 9. Put 9 under the 6.

ANSWERS TO EXAMPLES ON PAGE 3333. (1) 862. (2) 1. (3) 1340. (4) 1462. (5) 18.

TWO NEW GAMES OF THE FAIRIES

WE have already discovered that there are a great many things to learn before we can get the piano fairies to tell us all their beautiful stories.

We have been playing the game called " The Sleepy Arm," have we not ? The fairies look very pleased when they see our arms getting quite loose, because they know we are starting on the right way, and they will be able to make known to us their lovely secrets. So we must go on every day playing this particular game, for in fairyland, as in every other land, we learn and know that " practice makes perfect."

The fairies tell us three things. They tell us that we shall have to use (1) our arms, (2) our hands, and (3) our fingers ; but we must get them into such good working order that we have not to think about them, because we shall want all our mind, all our ears, yes, every bit of our intelligence, *to think the lovely sounds* we want to hear.

When we are walking or running we think of the place to which we want to go, do we not ? We do not keep worrying about the way we should put our feet on the ground. We have done it so often that the movement has become automatic—that is, the feet seem to move entirely of their own accord. That is just what must happen with our arms, our hands, our fingers. We must exercise them so well that at last we shall feel they are just doing what we want, *without any effort,* without any trouble.

To-day the fairies send us two new games of play. In the first one we go to the table, *not* the piano. We must sit down just as we do when we are playing the piano, extend our hand about three inches above the table, then, quite slowly, we shut the hand, just as if we were gathering up sweets, and as our fingers thus sweep towards the palm of our hand, we shall slightly raise the wrist joint ; then we will let the hand bound back again to its first position.

Our second game takes us to the piano. We let the soft little pad of our middle finger just touch Fairy C's note. We must only touch it very lightly, because we do not want to put the note down ; we just want to rest on its surface. So, keeping our finger just in the middle of the note, we are to move our wrist slightly up and then down again, about an inch each way. This game is called the " Fairies' See-saw," and the great thing to remember is that we must *keep our arm quite loose* ; there must never be the slightest stiffness.

These are the games the fairies want us to play with each hand alternately—that is, first one and then the other—for quite ten or twelve lessons, for everything we are doing is important.

One day a little girl said to her mother :

" It seems stupid to have to take so much trouble, because clever people do everything quickly."

She was a funny girl to have such a queer idea, was she not ? Perhaps we can guess the fairies' answer to such a thought. They told her a little story, and now they are whispering it to us.

Once upon a time there was a little boy named *Felix Mendelssohn Bartholdy* ; in the nowadays he is always called *Mendelssohn.* The pianoforte fairies were very fond of him, and he was devoted to them. He knew how much they had to tell him, and he worked hard to find out all they wanted him to know.

The days did not seem long enough for all he had to do, and he used to get up early so that no moments should be lost. If you and I had been in his home in Berlin, we should have found him hard at work at five o'clock in the morning. He took one holiday in the week, and that was on Sunday, which he very much enjoyed. Yet, though he worked so hard, he was very far from being stupid. He played at a big concert when he was only nine years old, and by the time he had reached eleven years of age, he had written quite a lot of music for himself and for all music lovers. If ever we go to the Royal Library in Berlin we shall be able to see some of his manuscripts, and I think we shall find how very neat they are, because Mendelssohn took great pains over everything he did. He grew up, became a great artist, and went on writing beautiful music for you and for me to know and to love.

MAKING SIMPLE PATTERNS WITH FLOWERS

IN making patterns, when we get our idea from flowers or leaves, we always have to leave out some of the details because they confuse the eye, and very fine work is only suitable for patterns seen quite close and where very rich ornament is necessary. Simple designs and simple colors are the most successful, and until we can draw very beautifully, we must not attempt anything elaborate.

Seed-vessels and bud of the rose.

The best way to get a good idea of the shape of the flower is to brushwork it in *neutral* tint—that is, to mix some brown, grey, or even black paint, and make the best copy we can of all the parts of the flowers.

We will choose to-day some flower or leaf—any flower will do—but one with five petals is best, because it is so useful for decorating all sorts of spaces.

English children love the rose specially because it is England's favorite flower. It has been painted on shields, carved on the ceilings of churches and palaces, and it was worn as a badge by the Houses of York and Lancaster, so that it gave its name to the Wars of the Roses.

The rose drawn in neutral tint from nature.

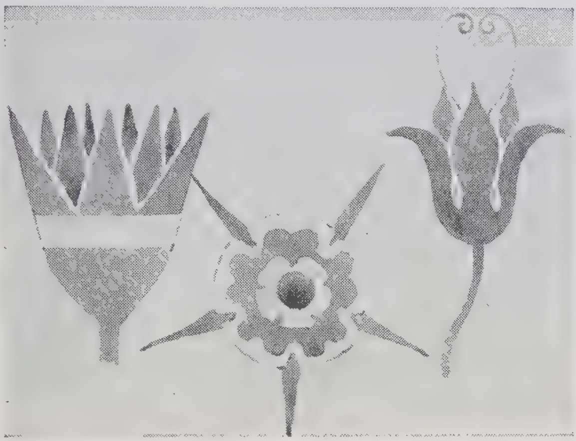
We hear often of the golden lilies of France, and, years before either the Britons or the French people existed, the Egyptians used the lotus flower for decorating their temples, their pottery, and their clothes. But these flowers are used in their very simplest forms; the delicate stamens and cut-leaf edges of the rose are not suitable for wood and stone-carvings, and the great secret of good designs is to suit the decoration to the material it is worked in.

Boys and girls who can carve and embroider can begin to make patterns for themselves now, and we will see what we can invent with a rose or any other flower as patterns, one for carving, and another for needlework. Suppose we have a frame to carve, we must have a pattern running all round, as the rose stem suits this style. We must have bold work, and we want contrast in all designs. The rose and its leaves will give us this. Of course, we are not going to copy the illustrations here, but invent for ourselves.

For embroidery, we can have finer work. It can be worked in silks or fine linen, and these are delicate materials and need delicate designs. We can go a little closer to the rose for this, and have the pleasure of copying the colors too, but must not try to put all the colors in. This would mean failure. Besides, we are not copying the rose itself, only making a pretty suitable pattern for our work out of ideas the rose

has given us, so we shall not attempt to give all the stamens or the veining of the leaves, but make our pattern flat and simple.

When we have sketched out the idea we can draw one corner very nicely, and use tracing paper for the other corners. Tracing paper can always be used in designing when we want to repeat exactly what we have already drawn; but we must be very careful to fit the edges of the pattern together.



The lotus, rose, and lily.

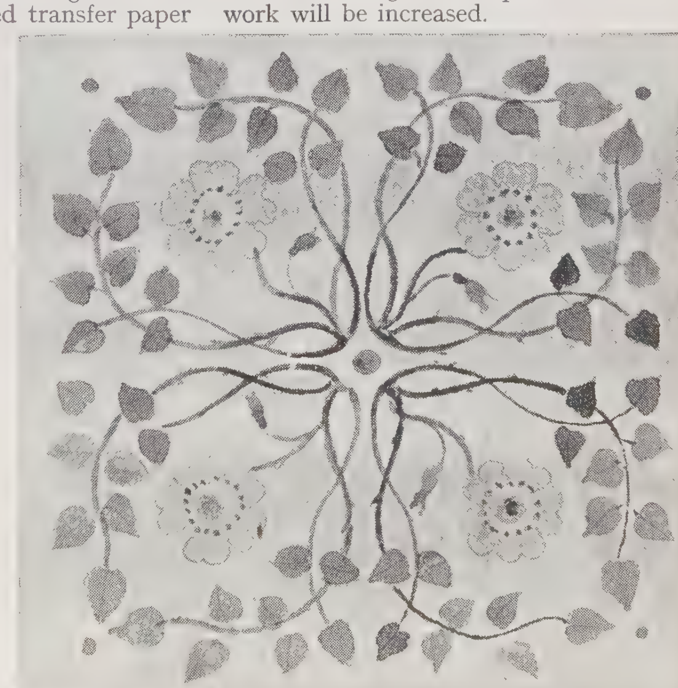
There is a paper called transfer paper which can be bought in three colors—red, blue, and black. When the drawing is finished, this is placed between it and the material, and the pattern traced with a blunt-pointed pencil or other instrument. Blue or black is best for wood, red for light-colored stuffs. There is also sold a white tracing cloth, which is useful for dark, smooth materials.

The cornflower is another very useful flower for designing, the thistle and the oak leaves are very suitable for carving, and we shall find it a help to model our designs in clay before we begin to carve them.

The rose drawn boldly for carving.

We can make covers for our sketch-books and blotters and other books, by painting on different colored linens. For this, the designs look best all in one or two colors, with a strong dark outline. If we want the pattern lighter than the background, we must use *Chinese White*. We can paint all the patterns white first, and afterwards, when it is quite dry, paint over it; or we can mix the color first, taking care to mix enough.

In most of our hobbies we find the need for patterns, and if we can paint our own designs, the pleasure in our work will be increased.



Pattern for needlework made from the rose and its leaves.

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Hier nos cousins ont donné une fête. Jeannette et moi nous étions invités.
Yesterday our cousins have given a fête. Jenny and me we were invited.
Yesterday our cousins gave a party. Jenny and I were invited.

Jeannette portait une robe de soie, et des souliers blancs. Elle était très belle.
Jenny carried a robe of silk, and some shoes white. She was very beautiful.
Jenny wore a silk frock and white shoes. She looked very pretty.

Nous sommes arrivés à la maison. Elle était illuminée du haut en bas.
We are arrived at the house. It was illuminated from the top in bottom.
We arrived at the house. It was lit up from top to bottom.

Dans le salon nous avons trouve quelqu'un que nous avons reconnu.
In the drawing-room we have found someone whom we have recognized.
In the drawing-room we found someone whom we knew.

C'était Annette. Je l'ai invitée à danser. Elle a mis la main dans la mienne.
This was Annette. I her have invited for to dance. She has put the hand into the mine.
It was Annette. I asked her to dance. She put her hand in mine.

La salle était decorée de fleurs. Ma cousine a donné une rose à Jeannette.
The room was decorated with flowers. My cousin has given a rose to Jenny.
The room was decorated with flowers. My cousin gave Jenny a rose.

A neuf heures nous sommes descendus pour le souper. J'avais faim.
At nine hours we are descended for the supper. I had hunger.
At nine o'clock we went down to supper. I was hungry.

Les fraises étaient très bonnes, mais j'aime mieux les glaces.
The strawberries were very good, but I like best the ices.
The strawberries were very good, but I like ices best.

Nous avons dansé le "Sir Roger de Coverley." Puis le bal était fini.
We have danced the "Sir Roger of Coverley." Then the ball was finished.
We danced "Sir Roger de Coverley." Then the ball was over.

Nous avons dit: "Bon soir," et nous sommes allés en voiture à la maison.
We have said: "Good evening," and we are gone in carriage to the house.
We said: "Good-night," and drove home.

THE NEXT SCHOOL LESSONS BEGIN ON PAGE 3465.


The fire dies down in the cottage. From the painting by Walter Langley, R.I.

WHY DOES THE FIRE GO OUT?

CONTINUED FROM 3234

A FIRE, or anything else that is burning, will go out if the supply of air or oxygen is stopped, or if that supply is made so scanty that the burning goes on very slowly, and so does not produce enough heat to keep the coal, or whatever is burning, at the temperature at which it is capable of combining with oxygen; or a fire, or anything else, will go out when there is nothing more left to burn. When a fire goes out in the ordinary way, there is still plenty of burnable stuff left in the grate; and there is still plenty of air in the room, of course; but there is not a good enough draught up the chimney, and the air of the room is not getting to the coal of the fire quickly enough. The air enters the fire almost entirely from below; but perhaps there are many ashes in the grate, choking up the spaces between the bars, and the air cannot reach the coal. So the fire dies of suffocation: it cannot get air. If we clear away the ashes the fire goes on burning.

HOW CAN THE FIRE IN THE CENTRE OF THE EARTH BURN WITHOUT AIR?

Almost everyone is puzzled by the two different ways in which a thing may give out heat and light. A thing does this when it is hot; but it may be hot either because it is burning, or for some other reason. The fire is hot *because* it is burning, and that is why it gives out heat and light; the thread in an electric lamp gives out heat and light *because* it is hot, but it is hot not because it is burning, but because it is made hot by electricity passing through it; the sun gives out heat and light because it is hot, but the sun is not burning. The sun is actually so hot that oxygen cannot combine with the other elements of the sun. The sun's heat is entirely due to other causes. Similarly, the centre of the earth is like a fire, since it gives out a great quantity of heat; but it is unlike a fire in that it is not burning any more than the sun is, or the thread in an electric lamp. We should use the word glowing, and then we can say that the sun and the inside of the earth are glowing though they are not burning. The current through an electric lamp makes the thread glow, though it does not burn. A fire, and many other things, glow when they burn because the burning makes the things so hot that they glow. Any kind of matter that is made hot enough will glow; that is to say, will give out light and heat. The proper way of saying this now is that it will radiate, or give off rays of light and heat.

WHY HAS THE EARTH NO LIGHT OF ITS OWN LIKE THE SUN?

There is no doubt that the earth had a light of its own long ago, and this thoughtful question very rightly suggests that the other planets, too, must surely have had a light of their own at one time, just as the sun has, because the sun and the planets were all made from the same hot cloud, or *nebula*. Now, the question we have to answer is why the earth should have become cool, while the sun still remains hot, so that it can no longer give out any light of its own, but can only reflect the sun's light. The reason is that the smaller a thing is, the more quickly does it lose its heat. The heat escapes from the surface, and the smaller a thing is, the larger is its surface in proportion to the amount of stuff in it. If we go to a place where people are making glass, and get them to make us three or four balls of glass of very different sizes, we shall find that the little one is quite cool when the biggest one is still far too hot for us to touch it.

A baby needs warmer clothing than a grown-up person, and small and thin people need more clothing than large people, because they have such large surfaces to lose their heat by in proportion to the mass of their bodies. As regards the solar system, we can learn especially from the moon and from Jupiter. The only reason why the moon should have become so much cooler than the earth, though it is made of the same stuff, is that it is so much smaller. On the other hand, Jupiter is very large, and astronomers are almost sure that the giant planet is still hot enough to give out some light of its own.

WHY DOES OIL BURN SO EASILY?

Oil is a word covering a great many things, but though these things differ in many ways—in taste and color and smell, and in their chemical composition—yet all oils agree in consisting of a very large amount of the two elements carbon and hydrogen. Many oils contain a certain amount of oxygen, but no oils contain nearly enough oxygen to satisfy the carbon and hydrogen atoms in them. If hydrogen is to be fully burned, every two atoms of it need one of oxygen, as in water, H_2O. If carbon is to be fully burned, every atom of it needs two atoms of oxygen, as in carbon dioxide, CO_2. No oil contains anything like this proportion of oxygen to the carbon and hydrogen in it, and so all oils are capable of being burned; that is to say, of being made to combine with oxygen—and they will go on burning until all the carbon and hydrogen in them have combined with all the oxygen they are capable of combining with; and then when the oil is completely oxidized it is completely burned, and cannot possibly burn any more.

IS IT BAD TO SLEEP WITH THE MOON SHINING ON US?

It is not bad to sleep with the moon shining on us, but it is very bad to believe nonsense. Every night that the moon shines, millions of animals sleep with it shining upon them, and if anyone fancies that it is bad for human beings to sleep out of doors, whether the moon is shining or not, he makes a great mistake. All notions of this kind are really remnants of the old astrology, which ascribed all sorts of influences to the heavenly bodies, and thought that lunacy—the word came from the Latin *luna*, meaning the moon—was caused by the moon. Moonlight is only reflected sunlight, and, though it is very feeble in proportion to its brilliance, it is valuable, just as sunlight is.

WHY IS IT DANGEROUS TO SLEEP IN A DAMP BED?

One of the greatest facts about water is the enormous amount of heat which it can hold, and the very great quickness with which it can take heat from anything else—in other words, it has a great capacity for heat, and it is a very good conductor of heat. When we sleep in a damp bed, then, the water in the sheets or blankets rapidly takes a large quantity of heat from our bodies—far more than dry sheets or blankets are capable of taking. This means that the temperature of our bodies is lowered because heat is taken from them more quickly than we can make it up by our burning. But if the temperature of the body and of the blood is lowered, its power of resistance to all sorts of microbes, such as those which cause pneumonia or inflammation of the lungs, and those which cause rheumatism, is also lowered. And so we are very liable to get any of these diseases, or influenza, or bronchitis, or a common cold, or some others. If we think that

the sheets on a bed are damp, we should take them away and sleep in the blankets. It is not so comfortable, but it is nothing like so bad as getting pneumonia.

WHY DO BABIES REQUIRE MORE SLEEP THAN GROWN-UP PEOPLE?

There is no doubt that babies do require more sleep than grown-up people of any kind, and the smaller the baby, the truer this is. It has been well said that "the whole duty of infancy is sleeping and feeding." Grown-up people require to sleep because they require a period of rest during which their bodies can save and make up for the wear and tear of the waking time. As long as a grown-up person's body can just maintain itself, each night's sleep balancing the loss and injury of the day's work, then all is well; no more is needed. But the body of a child, and, still more, of a baby, has far more to do than this. It has to make itself, whilst the body of a grown-up person is already made and merely has to maintain itself. The body of a baby or a child has to develop and grow. When it is awake, it takes its food by which it grows, but the real growing is done when it is asleep. Then the body uses the food which has been taken in the daytime, and builds it up into itself. If a child, and still more if a baby, does not get sufficient sleep, it cannot grow properly.

WHY, ON WAKING, DO WE SEEM TO HAVE SHUT OUR EYES ONLY A MINUTE AGO?

When this happens, the reason is that all our notions of time and its passage come from our consciousness of what goes on in ourselves. That is what gives us our idea of time; and so when we are asleep and unconscious, time does not exist for us, and when we wake, it seems as if time is going on from just where it left off at the last moment we can remember before going to sleep.

But I fear we shall find when we grow up — or perhaps, if we happen to be not quite well, even before we grow up — that our consciousness of time is not always cut off when we are asleep. Children sleep very deeply; if they did not they could scarcely become grown up. But grown-up people often sleep less deeply, and they may be so little asleep that, though they are not really awake, yet they have a sort of half-consciousness of things going on in themselves or around them, especially things in themselves. When we have had a night of this sort of bad, and almost useless sleep, and at last wake fully up in the morning, it by no means seems to us that we have only shut our eyes a minute ago. More often it seems as if the night had been ages long. An hour of deep sleep is worth more than many hours of light sleep, and the deeper our sleep has been, the more valuable sleep we have had.

DO OUR BRAINS WORK WHILE WE ARE ASLEEP?

Part of our brains works always, whether we are asleep or not. If that part stops working, then sleep must become death. This is a part of the brain about which we never feel or know anything directly ourselves; it is the lowest part of the brain, and has nothing to do with thinking or consciousness, but it controls the beating of the heart, and gives the orders to the muscles by which we breathe. The highest part of the brain, that has to do with thinking, is probably never wholly asleep except, perhaps, in babies and small children. But most of it should be asleep, which means at rest, when we are asleep. The deeper our sleep is, the more valuable it is, and the smaller is the part of our brains which is still at work.

Dreams and nightmares prove that our brains work while we sleep. But, quite apart from them, we can prove in many ways that much, even of the higher part of the brain, works while we are asleep. Thus, for instance, a man may go to bed trying to solve some problem in science, or to complete a piece of poetry he is writing, or to invent a new combination of the pieces in chess, or to find out how a crime was committed, or to write a tune to the words of a song, or to do a thousand other things of that kind—and in the morning he may wake and find that during the night, while he was asleep, the brain has done everything he wanted. A great poet once composed a poem in his sleep, and wrote it out the next morning. Sometimes, when the brain has done its work, it will wake the man up, and if one is to be awakened at night, that is the nicest way in which it can happen. The French have a very good proverb which expresses

this very well. It is, *La nuit porte conseil*—the night brings counsel.

HOW DO WE KNOW WE HAVE DREAMED WHEN WE ARE AWAKE ?

After all, this question, when we come to think of it, is only one regarding memory. We *remember* some of our dreams. A dream is an experience of a special kind ; it is something happening in the part of our brain which has to do with consciousness and experience, and the brain's general power of memory applies to this as it does to other cases. But, of course, the brain is in a peculiar state when we dream. The whole of it is not working, and so our recollection of dreams is, as a rule, not nearly so good as that of our waking experiences.

The more clearly we remember a dream, the greater must have been the part of the brain machine that was working at the time, and, on the other hand, there is no doubt that we have many dreams which we do not remember at all when we wake, and which were due to the working of only a very small part of the brain. We see from this that we can judge which dreams are the best kind to have, if we are to have any. The more definite a dream is, the more vivid it is, and the better we remember it. The more awake our brain was when we dreamed, the less was the rest it was getting, the poorer and less valuable was our sleep. But when a dream is scarcely remembered, or not remembered at all, and when it is very faint and vague, then our brain was much less awake during the dream and our rest and sleep were so much the less injured.

WHAT IS CREAM OF TARTAR?

Cream of tartar of course is not a cream at all. It is an alkali, or base, which is obtained from grapes in the process of making wine. As the juice of the grapes ferment, a substance called argol is deposited on the sides and bottom of the vat. The argol is gathered from the vats, dissolved in boiling water, and allowed to stand so that as it cools the heavy impurities that are in it may fall to the bottom as a sediment. As the water cools, the argol crystallizes and floats. It is now called cream of tartar, but is not yet sufficiently pure. To purify it still further, the crystals are again dissolved in boiling water. A purifying substance such as pipe clay or white of egg is added, and when the crystals have formed once more the cream of tartar is ready for use.

By the addition of bicarbonate of soda, cream of tartar is made into baking powder, of which large quantities are used in baking, especially in making biscuits and cakes. Cream of tartar is used in medicines and in making cooling drinks. It is also of importance in dye works, where it is used as a mordant in wool dyeing; that is, it is a substance which helps to make some colors " fast " so that the coloring matter will not run out of the wool when it is wet or washed.

DO WE SEE A THING IMMEDIATELY WE LOOK AT IT ?

Certainly not. Seeing, as well as every other kind of sensation, takes time. From the instant that the light strikes the curtain at the back of our eyes to the instant that *we see* is quite a long time compared, for instance, with the time it takes light to travel a mile. We are apt to think a second the shortest part of time that is worth mentioning, but that is absurd. A second is a period of time so long that light, radiant heat, and electricity could travel almost as far as the moon in such a time. The really wonderful thing about seeing is, that it takes such a small fraction of a second for all the things to happen which are necessary before we can see. Complicated chemical changes have to take place in the living cells of the curtain at the back of the eye. These changes have to produce special nerve currents, which in some amazing way correspond exactly to them, and these run along the eye nerves—first to a group of cells in the lower part of the brain, and then from them, along another set of nerves, to the real eyes—a group of nerve-cells at the very back of the brain, which themselves have developed, and have always lived, in utter darkness. Something happens in them, and then we say *we see*. The marvel is that only a few hundredths of a second are needed for all this that has been described to happen.

WHY, WHEN WE HOLD A LUMP OF BEET SUGAR TO THE GAS, DO RED DROPS COME ?

I think I would call these drops brownish rather than red, said the Wise Man, and if we try the experiment with a lump of cane sugar, I do not think we shall find much difference.

We shall notice that this stuff in the brown sugar has rather a nice smell, and indeed it helps to make very nice sweetmeats. Sugar is a very complicated chemical substance, containing carbon, hydrogen, and oxygen. When it is completely burned, of course it is all turned into water and carbon dioxide, but when we put a match to it, or hold it in the gas, it is only partly burned; in other words, the process of combining it with oxygen only goes part of the way, and so we get a number of oxidation products, as they are called, which contain more oxygen than sugar does, but much less, in proportion, than carbon dioxide and water. So, if we could go on oxidizing or burning the sugar, in the end we should oxidize or burn away this brownish red stuff completely into water and carbon dioxide.

WHY ARE DARK THINGS WARMER THAN LIGHT THINGS?

We can answer this question at once if we know the answer to the question, "Why are dark things dark?" A thing is dark, even in the light, because, instead of reflecting, or throwing back, the light from its surface, it keeps the light, or, as we say, absorbs it. Light and radiant heat are really the same thing, and as a rule anything which absorbs or reflects the one, absorbs or reflects the other. So light clothes throw back from their surface the light and the heat that strike them. Probably nothing will throw back all the light and heat that strike it, and even the whitest snow will melt under the sun's rays. But while light things keep only a little of the light and heat that fall on them, dark things absorb practically the whole, and so, of course, they become warm. Thus a suit of white flannel, for instance, will become really warmer to wear if it is simply dyed black.

HOW MANY MILES IS THE SKY FROM US?

What we call the sky is nothing but the appearance of blue that we get on a bright day, owing to the fact that particles in the air reflect the blue part of sunlight to our eyes. When we see the blue sky, then, what we really see is air. The height of the particles that reflect this blue light to our eyes is not very great. It is perhaps fifty or sixty miles at the most, and, compared with the size of the universe, that is nothing at all. But by the sky we may mean, not the blue sky of daytime, but the great space around us, that we may see on any bright night. We see vastly farther then than in the daytime, because we can see right through the air out to the stars; whilst in the daytime the sun is lighting up all the air around us, so that, though we seem to see a long way, we really cannot see past the lit-up air—except when there is something very bright beyond it, such as the sun itself, and sometimes even the moon.

DO WE KNOW HOW FAR THE SKY REALLY GOES?

If we study the distance of the stars, that in itself, of course, teaches us something as to "how far the sky really goes." But when we have learned the enormous distances of some of the stars which we can see—distances so great that there is no space to write them in miles, and so we have to speak of light-years, meaning the distance that light travels through in a year—even then we have not begun to say how far the sky goes. If we had a telescope a million times bigger than the biggest we have, and then could find with it the farthest star that it would reveal, we should even then be no nearer the end of the sky than we are now, for there is no end to it. If we traveled out in a straight line through the sky for ever, we should never reach the end of it. That is what we mean when we say that space is infinite, which is simply the Latin word for unending.

WHY DO THE HILLS LOOK BLUE AT A DISTANCE?

The blueness of the sky is due to the blueness of the air, which looks blue to us because tiny specks of matter floating in it reflect the blue rays of sunlight to our eyes. Now, if we look through a layer of anything that is colored at something beyond it, the layer will contribute its own color to the color we see. The blueness of the air, however, is a very faint blue, and we do not usually notice the blueness it contributes to anything near. But when we look at distant hills, we are looking through such a thick layer of air that it gives them a blue tinge. But the actual color which we see depends upon many other things, as, for instance, the color of the hills themselves, and the time of day—which decides the angle at which the sunlight falls

upon the hills, and also affects the color of the sunlight. That is enough to explain why the color of hills is so varied and changes from moment to moment.

IS THERE ANY WATER IN THE SUN?

We are quite certain that there is no water in the sun. We know that both oxygen and hydrogen exist in the sun, just as they do in the earth, and we cannot doubt that, as they have a great attraction for each other here to form water, they must have a great attraction for each other there. Yet there can be no water in the sun, because the sun is so hot that none of the elements, not even oxygen and hydrogen, can combine with each other there. By producing intense heat, we can force the oxygen and hydrogen of water apart, and that is what happens in the sun—or, rather, the sun has never been cool enough to allow them to come together.

IS THERE ANY WATER ANYWHERE EXCEPT IN OUR WORLD?

Oxygen and hydrogen, which, when combined, form water, are found wherever we look for them through the universe. In the case of our own solar system, we can prove that, wherever the temperature is not too high, there oxygen and hydrogen, if found together, will combine to form water. That is true of our own earth ; but, as we have seen, the sun's temperature is too high for it to be true of the sun. We should expect some of the other planets besides the earth to be cool enough for water to be formed, and in the case of the planet we know best, which is Mars, this is so. We have known for several years that something, which looked and behaved exactly like water, gathered at the North Pole and South Pole of Mars, forming caps of what looked like ice, that increased or decreased at each Pole according to its winter or summer. We also see occasional, but very rare, clouds in the atmosphere of Mars. Many people, however, said that the Polar caps of Mars were not made of water, but of solid carbon dioxide, which looks like snow ; but it has quite lately been proved that what looks like water on Mars *is* water, and so this very important question is answered.

WHERE DOES THE SEA-WATER GO AT LOW TIDE?

The shortest answer to this would be that, at low tide, the water goes to the places where it is high tide. As the earth spins under the pull of the moon and the sun, the water is always being moved about. Of course, it is always somewhere, and if it is not in one place, it must be in another. When it is pulled to one part of the earth and heaped up there, that makes high tide. As we watch the tide rising, what we see is the water being heaped up in our neighborhood, mainly under the influence of the moon. But if it is heaped up there, it is being drawn away from somewhere else, and that somewhere else is the place where the tide is ebbing. No tide rises but some other tide falls.

WHY DOES IRON FEEL COLDER THAN WOOD?

Our feeling whether anything is hot or cold does not depend wholly upon how hot or cold the thing really is. The marble on the washstand and the towel beside it are both of the same temperature, but the marble feels much colder than the towel. All the parts of a hammer are at the same temperature—unless, of course, one end of it has been heated—and yet the iron head feels much colder than the wooden handle. In all these cases the thing we feel is colder than our skin as a rule, and so heat will flow from our skin into the thing. Our feeling entirely depends on the rate at which the thing takes heat from our fingers. Marble and iron take heat quickly from our fingers ; they quickly make our fingers cold, and so we say that they are cold, meaning really that they make us cold.

But wood and cotton do not take heat away nearly so quickly from anything warmer than themselves, and so we say that they are not so cold. Really we should say that marble and iron are good conductors of heat, but wood and cotton are bad conductors of heat.

WHY DO DARK THINGS LOOK SMALLER THAN LIGHT THINGS?

When we see a dark thing against a light background or a light thing against a dark background, it is really, of course, only the light that we see. We see a perfectly dark thing only by contrast with the light around it, and if the light around it were not there, we could not see it at all. We cannot see darkness. Now, it is an interesting fact about the eye, which it is not difficult to understand, that when any part of it is excited by light, the effect

of the light spreads a little all round the edge of the part of the eye on which the light falls. It is as if the little light at the edge of it radiated sideways, and so it is called *irradiation.*

Now, when we see a black spot, like a blot of ink, on a piece of white paper, irradiation works in the eye, of course, so as to make that spot appear smaller than it really is, for all round the edge of the part of the eye which is opposite the spot, and on which the light is not falling, a little of the effect of the light from the white paper is being felt. When we see a white spot on a dark background, irradiation works outwards from the white spot into the part of the eye which is really opposite the dark, and so the white spot looks bigger than it really is.

WHY ARE SOME PLANTS POISONOUS?

When we say a thing is poisonous we mean that it is poisonous to us. Some things which are poisonous to us are poisonous to all living creatures, but most things are poisonous to some creatures and not to others; indeed, they may be very good for the others, just as when we say "one man's meat is another man's poison." So long as we have the old idea that every living creature exists for our benefit, it is indeed a puzzle why some plants should be poisonous, why some snakes should be poisonous, why there should be disease-causing microbes, or why tigers should have claws. But if we understand that every living creature exists *for its own sake,* then we shall look at the claws of the tiger, or the poison of the snake or plant, and ask: "How do they serve the life of the creature that has them?" We are only now beginning to learn the meaning and the uses of the various chemical compounds, poisons and others, which we find in plants. Some of them seem to be waste products of which the plant is gradually getting rid; or sometimes the poisons of a plant exist to warn off insects, or other forms of life, which would injure the plant.

WHY DOES IT THUNDER, AND ON WHICH SIDE OF THE CLOUDS IS THE THUNDER?

Thunder is a noise, an irregular wave in the air. Its cause is the very sudden heating of the air, high up above our heads, by the quick passage of electricity through it from cloud to cloud, or from a cloud to the earth. Air offers great resistance to the passage of electricity through it, and when anything resists the passage of electricity, that thing becomes hot. If it becomes hot, it expands suddenly, and so it starts the air-wave we call thunder. A sound—and the same is true of a light made at any place—spreads out, if it can, quite equally in every direction. So the sound of the thunder spreads upwards from the clouds, downwards from the clouds, and sideways through the air and through the clouds themselves. The part we hear is, of course, the part that reaches our ears, part of the wave that spreads downwards from the place where the electricity passed and started it.

HOW LONG DO MICROBES LIVE?

The answer to this question is one of the most extraordinary facts in the world. Of course, a microbe, like anything else, may be killed because it is poisoned, or crushed, or made too hot, or because the water is taken out of it, or, most commonly of all, because it cannot get enough food. But when we ask this question about microbes, we mean: How long do microbes live naturally? And the answer is that *microbes do not die.* The natural end of the life of a microbe, and of other living creatures like the microbe which consist of only one cell, is not to die, but to divide into two pieces, each of which grows and becomes a new microbe, as we see in the pictures on page 821. That is the very simple way in which the race of microbes goes on. If the whole body of a living thing divides into two parts which become two living things, each of which does the same in its turn, then we cannot say that in such a case death happens at all. Many a long book might be written on all that this means, when we compare it with the other kinds of life with which we are so familiar.

WHAT IS THE SHORTEST LIFE IN THE WORLD?

Microbes, and many other creatures, belong to a group of plants with a special name that means the plants that split, because they split into two, so as to form new microbes. From the moment that one microbe has split, until its two halves, having grown themselves, split in their turn—we may call the length of a microbe life. It is

the shortest life in the world. The microbe that causes cholera, for instance, splits into two after about twenty minutes, reckoning from the moment when it was first formed out of half of the microbe that went before it. One microbe in twenty-four hours has been found to multiply into eighty thousand. But we must, of course, understand that the rate at which microbes grow, and split, and so multiply, depends upon conditions, and especially upon the food supply. If there is not enough food, or if there is a tiny quantity of some antiseptic, perhaps, such as carbolic acid, the microbes may remain for a long time without splitting, or they may be killed.

WHY DO NOT ORANGES GROW IN MAINE?

Every kind of living creature has certain conditions in which it is fitted to live, certain places which it inhabits. So we use a special word, and say that the sea is the *habitat* of the fish, England of oaks, Spain of oranges, and so on. Some creatures can live in a greater variety of conditions than others. We know only one creature that can keep himself alive in any part of the world, and that is man. But even he lives and works best neither in the tropics nor in very cold countries. Of all the conditions which affect the growth of living things, perhaps temperature is the most definite. Thus, when we go up a high mountain in a warm country, we can trace, as we go upwards, different kinds of plant life, each corresponding to different levels as the mountain gets higher and colder. The orange-tree is one which requires a hotter average temperature of the air than is found in the northern states, though by no means the very hottest to be found anywhere. So if men alter this one condition of temperature, we can make the orange-tree grow in the north quite well, as may be seen in hot-houses.

WHEN WATER IS BOILING, WHY CAN IT NOT BE MADE HOTTER?

When water is boiling it can be made hotter, but not as liquid water. Water, like other things, has a certain temperature above which it cannot be a liquid, but must be a gas, and below which it cannot be a gas, but must be a liquid or a solid. That point we call the boiling point. We cannot make water hotter than boiling point, because when we do it ceases to be what we usually call water, and turns into gaseous water, or water-vapor, but it is quite possible to make water-vapor hotter than the temperature of boiling water. If we go on boiling water, we are certainly putting heat into it; and we must not fancy that because the liquid water becomes no hotter, the heat is being lost, or wasted, or turned into nothing. Nothing is ever lost, or turned into nothing. What the heat does is to put itself into the liquid water, so that that liquid water takes the form of a gas, and the heat still remains, though quite changed, in the energy of movement of the parts of the gas. We can easily prove that the heat is doing something, though it is not making the water hotter, when we find that if we go on boiling we boil all the water away; that is to say, we turn the whole of it into water-vapor.

WHY DO WE SOMETIMES SAY "GAS" AND SOMETIMES "VAPOR"?

It is a pity to have two words for the same thing, when they confuse people. You and I, said the Wise Man, are rather apt to think of a vapor as something in the air that we can see; that is to say, something that we cannot see through. But a vapor is really a gas, and a gas is a vapor. Only when a thing at ordinary temperatures is usually gaseous do we call it a gas. When we know a thing best as a liquid or a solid, such as water, we call its gaseous form a vapor. So a vapor is simply a gas, or the gaseous form of a thing that we know best as a liquid or a solid.

WHY DOES BOILING WATER FEEL LIKE COLD WHEN WE PUT OUR HANDS IN IT?

Though we can gain no knowledge except through our senses, we know that they are very apt to deceive us; and the general rule about this is, that the senses deceive us least when they are concerned with something to which we are accustomed; but they deceive us most when there is something unusual about the thing we are feeling or seeing. Another general rule is, that the senses are apt to deceive us when they are being excited very intensely. They work best with things to which they are accustomed, and with things that excite them neither very little nor very much. In the skin of the hand, there are special arrangements for feeling both heat and

cold, and it is a very interesting fact that, as the question points out, when the sensation of heat is extremely acute, the brain is deceived for a moment or two, and makes us feel as if we were touching something very cold. But no one can explain how this mistake comes about; only this question is well worth thinking about and storing away in our minds with other instances of the mistakes that our senses make.

HOW DO CLOUDS STOP SUNLIGHT IF THEY ARE PURE WATER?

In all its forms, water stops and takes into itself a certain amount of the light of the sun. We know that liquid water does this, for it very soon becomes darker as we go down through it. Solid water, or ice, does so, too. Gaseous water does so least, and the gaseous water which is always present as part of the air does not stop enough of the sun's light for us to notice. But water in the form of round drops suspended in the air, which is what clouds really are, can stop a great deal of sunlight.

We can understand this at once if we remember what a soap-bubble looks like. Here is a bubble made mostly of water; it has a beautifully bright and glittering surface. That means that the light falling upon it is very largely thrown back from its surface. So if there is a cloud made of millions of tiny bubbles or drops—which are also glittering things—it will throw back a great deal of the light that falls upon it. We can understand this when we see the lighted side of a cloud. Nothing could be more perfectly white than the clouds like snowy mountains, which we often see. They are white and bright just because they do not allow the sun's light to pass through them, but reflect, or throw it back, from themselves.

WHY CAN WE HEAR THE SCRATCHING OF A PIN AT THE OTHER END OF A POLE?

Sound is made of waves in matter, waves of a certain kind and rate which our ears can hear. Any kind of matter may be thrown into these waves, and so may convey sound. The thing that conveys the sound, and in which the waves are, is called the medium, which really means the *thing between*. By far the commonest medium for sound in our case is the air. In the case of fishes, of course it is the water. But many solid things convey sound-waves extremely well, and when we scratch one end of a long pole with a pin, the matter of which the pole is made is thrown into a series of waves, that go on as long as the pin continues to move, and that we can readily hear through our ear, or perhaps even by merely putting our end of the pole against the side of our head or against our teeth; but the ear is best because it contains special arrangements for conveying sound-waves to the real ear inside our head much better than the bones of the skull or face can do. We have all heard stories of how the Indians can hear sounds at great distances by putting their ears to the ground, and this shows us that the earth may convey sound-waves—that is to say, waves which our ears can feel and appreciate as sounds—just as well as air, or water, or a pole.

WHY DID THE PEOPLE OF LONG AGO LIVE LONGER THAN PEOPLE DO TO-DAY?

Ah, but before answering this question there is another question that must be asked first: "Did people who lived long ago live longer than people do now?" And I have no doubt at all that the answer to that is "No." In all sorts of old records we are told that people lived to great ages; but there are many ways in which this can be explained, one of them being that there were different ways of reckoning age in those days. All the real evidence that we can get from the study of the past, and from our knowledge of uncivilized peoples now on the earth, shows us quite definitely that the average duration of human life is increasing. The expectation of life, as it is called, of the people who live in our land now is definitely longer than it was twenty, or even ten, years ago, and far longer than it was a hundred years ago.

Perhaps we have noticed that when human beings are children, there is a time when they can hardly distinguish between facts and things that they have imagined. Similarly, when mankind was younger, historians mixed fact and fancy, not desiring to deceive, but probably because, in their own minds, they could not keep the two things apart. Many of their fancies were worth putting down and keeping, but nowadays we must try to learn which was fact and which was fancy in what they tell us. Only thus shall we get right ideas of the past.

THE NEXT QUESTIONS BEGIN ON PAGE 3505.

AT THE TOP OF THE MOUNTAINS OF TYROL

Whether we would have quiet valleys, and hospitable people to dwell among, or thrilling heights to conquer, we may find our desire in Tyrol. This is one of many impressive scenes familiar in this land.

WHAT THIS STORY TELLS US

IT is natural that we should give most of our space to men and women who have written in English. That is our own language and we can read it more easily and can understand better what they wish to say. We must not think, however, that all great writers use English. We tell you something in other stories of the writers of other lands, and below you will find something about some who have written in German. In the Book of Poetry you will find translations of some of their poems, which are better known to us than their plays or their novels. We mention below only those whom we do not find in other places. Some of the German songs are sung everywhere.

FAMOUS GERMAN WRITERS

CONTINUED FROM 3294

THERE have been other great writers of the German language besides Johann Wolfgang Goethe and Friedrich Schiller. These two authors, justly considered the most famous, are described in another section of THE BOOK OF MEN AND WOMEN. Goethe especially had a remarkable influence upon the literature of Germany, and of Europe in general.

Richard Wagner, the composer, has said that the literature and music of any particular people must differ from that of any other people because of the difference of both temperament and language. For this reason we must notice the condition of Germany during the time when a great many of these writers lived and wrote. As early as the twelfth century, when Walther von der Vogelweide lived, the German states were constantly at war. The struggle at that time was between the popes and the emperors. Then, too, we have the wars between the different states of Germany, for until the nineteenth century Germany was not united at all, but was divided into many small states. These states were governed by rulers who spent much of their time either fighting or robbing one another, for the emperor had little real power. You must remember that the old German Empire, or the Holy Roman Empire, as it was called, was not at all like the German Empire of to-day.

We must remember also the many wars with France. The desire to conquer Napoleon inspired many patriotic outbursts in song which are read to-day. When we think of the unsettled condition of Germany it is easier to understand the temperament of many German writers in the past.

WALTHER VON DER VOGELWEIDE, THE "SWAN OF GERMANY"

Walther von der Vogelweide, besides being the greatest of medieval poets, is the most interesting writer of his time. He was born in the latter half of the twelfth century, though both the year of his birth and his birthplace are unknown. The town of Botzen, in Tyrol, erected a fine monument to his memory, but we cannot be sure that he was born there. It is also claimed that he was born near Sterzing. He grew up in the country and learned to love country things, such as birds, flowers, running brooks and trees. It is curious to note that the name of Vogelweide, which means "bird-meadow," was probably adopted by the boy because of his love for nature. There is also a wood called by the name of Vogelweide, which might have suggested the name to him.

As a young man, Walther went to Vienna and lived at the court of Duke Friedrich. There he learned to sing and write poetry, but unfortunately Friedrich soon died, and the

new duke did not care for the poet. Consequently Walther left Vienna and became a traveling singer, journeying from one royal court to another composing and singing his works. His manner and his gentle birth gained for him access to all the courts, and his beautiful songs of religion, love, and chivalry were joyfully welcomed everywhere. His travels took him from Hungary to France and from Northern Italy to the Baltic Sea. At the home of the landgrave of Thuringia Walther spent a considerable amount of time. The duke appreciated the young man's work, and upon his advice, had a singing contest at the Wartburg. All the minnesingers or bards came from far and near to sing in the match. All children ought to hear Richard Wagner's famous opera "Die Meistersinger," which is based on the incident of the song contest in Walther von der Vogelweide's life.

The poet was also a great patriot and in the frequent struggles between the Pope and the Emperor, Walther sided with the Emperor. After singing for more than forty years, the bard died about 1230 and was buried at Wurzburg. His grave is under a huge tree, the spreading branches of which cast a shade over the tomb of the "Swan of Germany." According to his wish there was always food provided for the many singing birds which lived in the tree.

We shall next speak of Gotthold Ephraim Lessing, who lived almost six hundred years later, in the most productive period of German literature.

GOTTHOLD EPHRAIM LESSING, DRAMATIST, CRITIC AND POET

At Kamenz, in 1729, was born the first great German man of letters. By a man of letters we mean, one who is interested in many different kinds of literature. At the age of seventeen Lessing went to Leipzig to study theology, expecting to become a minister, as his father was. When he arrived at the university, he discovered that there were other things which interested him more than preparing for the pulpit. He felt ignorant of social forms and therefore took up horseback riding and fencing, and in other ways set about acquiring the style of a Saxon gentleman.

While with his cousin he met several dramatists and actresses and became very much interested in the stage. His father heard of this, and, as he was a minister, highly disapproved of his associating with actresses, who at that time were not received in refined society. He called his son home, but allowed him to return to Leipzig, upon the promise that the young man conscientiously study medicine.

Lessing could not keep away from the theatre, and became acquainted with a certain Frau Neuber, who managed a small theatre. She produced his play "The Young Scholar" in 1748 and thenceforth Lessing devoted a great part of his time to the writing of drama. The Neuber company disbanded soon after, and Lessing migrated to Berlin to try his fortune. Besides writing for the newspapers, he studied the Greek and Roman classics and read many Italian, Spanish, French and English books.

His first work of importance was "Miss Sara Sampson," a play written in 1755. The most noteworthy part of this drama was the fact that the characters were ordinary folk, not kings and queens, the usual subjects for plays. "Miss Sara Sampson" was unique in that it departed from the French type, which the German writers most frequently used. The Seven Years War developed a new patriotism in Prussia and consequently the play "Minna von Barnhelm" was written.

Lessing studied and revived Greek literature and art in Germany. He believed that the Greeks were the final authorities in matters of art, and in 1766 his "Laocoön" was published. This made the writer one of the foremost of European critics. In "The Hamburg Dramaturgy" Lessing again displayed his remarkable ability as a critic. The writer's greatest work was written two years before his death in 1781. It was a drama in verse called "Nathan the Wise." The play attempts to show that noble people may be found in all creeds.

HERDER, WHO WROTE ON THE ORIGIN OF LANGUAGE

The figure which now claims our attention is Johann Gottfried von Herder, who was a far greater scholar, translator and collector than he was a poet. Herder was born at Mohrungen, in East Prussia, on August 25, 1744. His parents were very poor, and only by sacrificing themselves, were they able to

allow the boy to study medicine. He soon discovered that he could never become a physician because it made him ill to witness an operation. Abandoning the study of medicine, he went to Königsberg and studied theology. He then settled at Riga as teacher and preacher. Herder took a great interest in French, German and English literature; he did not neglect the Bible, and after making a careful study of this book, discovered some things about the history of religion which had been unnoticed.

In 1767-68 Herder published "Fragments on Recent German Literature." Up to this time people believed language was a gift sent from Heaven and that God had given each country a different language. The author showed that the primitive peoples expressed their emotions of fright, fear and admiration, by high pitched sounds and violent gestures. With increasing knowledge fear and admiration were softened and man became more familiar with his surroundings; finally the very surroundings had an influence upon the sounds he made and in this way the different languages were evolved.

Weimar was the home of Goethe, Schiller and Herder. The house in which Goethe lived now belongs to the state, and has been left in every respect as the poet and philosopher left it. The house itself is a good example of the residence of a wealthy man at the end of the eighteenth century. It is visited by thousands.

Herder also believed that poetry was the natural way of expressing feelings, because in his study he discovered that poetry had reached a high point before we have any record of prose writings. In his advice to his countrymen Herder suggests that instead of trying to imitate the Greeks, they

try to be original so that Germany may have a literature of its own.

In 1778 was published "Voices of the Nations in Song," a splendid collection of folksongs. This was the first collection of folksongs made by a German thus far. Herder died in 1803.

HEINRICH WILHELM VON KLEIST, POET, DRAMATIST AND NOVELIST

This poet, dramatist and novelist was born at Frankfort on Oder in October, 1777. Heinrich von Kleist was a poor Prussian nobleman, who joined the army when very young. He retired as a lieutenant, and endeavored to continue his neglected studies. The young man began bravely enough and pursued his ideal of culture. Study, however, soon tired him and he decided to travel in search of peace of mind. This writer was very morbid; he believed that every one wished to harm him and that his relations and friends were untrue. During his travels he met Goethe and Schiller. Kleist believed that he was far greater than Goethe and is quoted as saying: "I will soon snatch the crown from the head of Goethe." The great author sympathized with the strange young man and said that Heinrich von Kleist seemed to him like a human form beautifully made by nature and afflicted with an incurable disease.

Kleist became engaged to a young lady, and decided to live on a farm in Switzerland. She, however, did not approve of this and immediately broke the engagement. The young man lacked self-confidence, and this, combined with his morbid nature, was disastrous. You may say that a man who thinks he is greater than Goethe does not lack self-appreciation, but this remark was made during a sudden burst of enthusiasm.

His first work was "The Schroffenstein Family," a tragedy in verse very much like Shakespeare's "Romeo and Juliet." Between the years 1806 and 1808, two remarkable dramas appeared, "Penthesilea" and "Kathie of Heilbronn." He also published a comedy, "The Broken Jug," and several other plays. In 1808 Kleist wrote a novel, "Michael Kohlhaas," which deplores the injustice of the laws of Germany at the time when Kleist lived. He saw that the only way to have proper government, was to join all the small principalities and have one ruler for all. He shows the advisability of this in his plays, "Hermann's Battle" and "Kathie of Heilbronn."

The poet was offered a commission in the army in 1811 and requiring a uniform decided to borrow some money from his relatives. Having already frequently supplied him, his family refused to give any more money. He became very despondent and entered into a death compact with a musician, Frau Henriette Vogel. He shot her and then took his own life on the shore of the Wannsee near Potsdam.

We now turn from Kleist to a man who in many ways was his opposite. We have been speaking of an eccentric genius of noble family, and next we have a simple man of the people, who knew no greater joy than that of standing by his window and listening to the students singing his songs.

LUDWIG UHLAND, ONE OF GERMANY'S MOST POPULAR SONG WRITERS

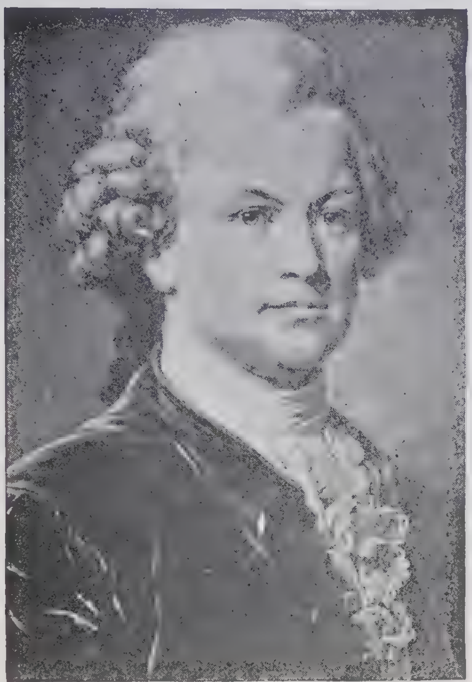
Ludwig Uhland was born in Tübingen, April 26, 1787. He was a son of a Swabian professor, and studied in the university of his native town. Even in his early songs there is a certain remarkable simplicity and depth of feeling. Among his earliest poems are "The Chapel," "Shepherd's Song," "The Mountain Song," "Farewell" and "The Castle by the Sea." This last poem is contained in THE BOOK OF POETRY. The most productive period of Uhland's life fell at the time when Germany was struggling against Napoleon.

No poet knew better how the common man feels than he, and this is well illustrated in "The Good Comrade," and "The Landlady's Daughter." Uhland also wrote many ballads. The most popular are "Taillefer," "The Minstrel's Curse" and "The Luck of Edenhall." Next to Schiller, Uhland is the most popular of all German poets. Although he did not write a great deal of poetry, most that he did write is popular to-day and many of his songs have been set to music. The poet died in 1862.

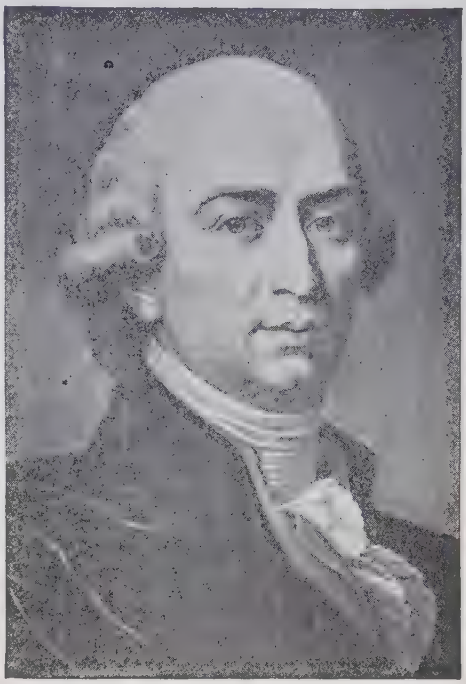
FRANZ GRILLPARZER, THE MOST FAMOUS WRITER OF AUSTRIA

Born in 1791 at Vienna, Franz Grillparzer early in life had a desire to write. It was not so much ambition as the desire to express his thoughts and feelings that prompted him. He was a very nervous boy, but when he decided

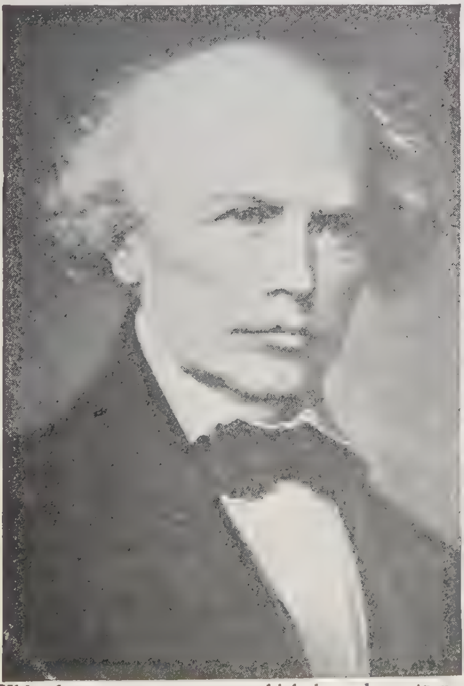
FOUR GREAT WRITERS OF GERMAN



Lessing was one of the first Germans to become interested in the writers of other lands. He began to study theology, but could not keep away from the theatre. He wrote plays and much about plays also.



Herder attempted to study medicine, but turned to theology, and then to the study of language. He spent the last years of his life at Weimar, which was also the home of Goethe and Schiller.



Uhland wrote many songs which have been translated into other languages, and are often sung. He was the son of a university professor, and studied in the University of Tubingen. He died in the town.

Though Heine was born in a German state, and wrote much in German, he felt more at home in Paris, where he spent the last years of his life. He wrote poetry, plays, essays, and travels.

to do anything he usually accomplished his purpose. Working in a government office in Vienna during the daytime he wrote plays at night. Like Kleist, his own work did not satisfy him and he was constantly in despair. In 1817 he won fame suddenly by writing "The Ancestress." This was followed by two more plays, "Sappho" and "The Golden Fleece." The stories of these dramas were taken from the Greek. No doubt you have read the story of "Jason and the Golden Fleece" in your mythology.

After this he wrote two plays, not often read at present, but of interest in 1825 because they were taken from Austro-Hungarian history, namely "King Ottokar" and "A Faithful Servant." The drama which is considered Grillparzer's best work is "The Wave of the Sea and of Love," written in 1831. This is a dramatization of the Greek story of "Hero and Leander," which, of course, you know. The author spent ten years writing and rewriting this tragedy. He died in 1872.

We shall next consider an author who, although he led a comparatively uneventful life, is the author of a well known work. Karl Leberecht Immermann, dramatist and novelist, was born April 24, 1796, at Magdeburg. Just as his father, Immermann held a minor official position, and consequently he was compelled to divide his time between literary work and the official duties. In 1815 he fought in the battle of Waterloo and also marched into Paris with General Blücher.

IMMERMANN, WHO WROTE "MUNCHHAUSEN"

We hear of Immermann chiefly because of his great satirical novel "Münchhausen." In this book, the author attempted to portray all the follies of the times. This novel is often called a "romance of humbuggery." Each one of the important characters is the victim of certain illusions, or in other words believes that he can do and has done impossible things. Very often even at the present time when a person doubts another's word he is apt to say "You are just like Münchhausen." Immermann died in 1840, after having written two other tales, "Merlin" and "Die Epigonen," and several plays. He also managed a theatre at Düsseldorf for some time, but it was not successful.

HEINRICH HEINE, THE WRITER OF SONGS

The life of Heinrich Heine is one of the most interesting of any of the great German writers. He was born in Düsseldorf on Rhine in 1797. When about eighteen years old he went into business with his uncle, a wealthy banker of Hamburg. Here he fell desperately in love with his cousin Amalie Heine. She did not love him, and love is the subject of many of the writer's most famous poems. His uncle, having great faith in the boy, decided to establish him in business; unfortunately in six months Heine failed. Heine was born a Jew, but because of the prejudice against the race in Germany at that time, he changed his religion, not because he admired the Christian faith, but because he believed that a Jew could never receive the proper recognition. This fact had a great influence upon the man's life, because it naturally follows that a man who did not have the courage and strength to adhere to his religion could not have been sincere in his writings. His whole career was poisoned because he could not live according to his ideals.

The poet went to Bonn to study law and then to the University of Göttingen, where he was suspended because he was found engaging in a duel. From Göttingen Heine went to Berlin, and upon his arrival there was told that Amalie Heine had married. This further helped to unsettle his morbid, ill-regulated mind. He obtained money from his uncle and went to Cuxhaven, on the North Sea, where many of the best sea poems were written.

Later he returned to the university, and afterward lived in Munich and Berlin. His "Reisebilder," or "Travel Pictures," brought him fame, but he decided to go to Paris to live in 1831. There he married an ignorant girl, whom he loved very much until his death in 1856. The last years of his life were passed in horrible suffering from an incurable disease.

Although Heine wrote plays and essays his best writings were in verse form. The poem, the first line of which is "A pine tree stands deserted," is nothing more or less than a portrayal of the author.

The poet's most famous works are

"The Book of Songs" and "Travel Pictures." Some of Heine's lyrics may be found in The Book of Poetry, and after reading them you will understand why such a well known composer as Franz Schubert has written music for them.

Two affectionate brothers who worked together

In another place we told of the fairy tales collected by the Brothers Grimm, but these were not their main work. Both were learned professors who studied not only the German language but all languages and the habits, manners and beliefs of ancient peoples.

Jakob Ludwig Karl Grimm, the elder, was born at Hanau in 1785, and his younger brother, Wilhelm Karl, a year later. Both were educated at the University of Marburg, and then were separated for a few years. Jakob studied in Paris, and was in the employment of the government of Hesse for many years, while Wilhelm was a librarian.

Both of them were invited to become professors at the University of Göttingen, but they objected when the king of Hanover took back the constitution he had given to the state, and were banished. In 1840 they were invited to come to Berlin, and lived there until they died, Jakob in 1863, and Wilhelm in 1859.

Friedrich Christian Hebbel, dramatist

Friedrich Christian Hebbel, the son of a poor bricklayer, was born at Wesselburen, March 18, 1813. His early life was a hard struggle, because his family could not understand why the boy wished to enter upon a literary career. They believed a position in a business, or a profession where more money could be made, would be better. Hebbel while at school sent some verses to a newspaper. A popular journalist of that period, Amalie Schoppe, discovered these poems and made it possible for the young man to secure an education. He was not grateful and took it for granted that people ought to be glad to help him. After leaving the university he appealed for help to a friend, Elsie Lensing. The young girl sacrificed much to aid him, and Hebbel as soon as he became famous forgot the girl, and what she had done for him.

In 1839 his verse tragedy "Judith" attracted the attention of a Berlin actress, who successfully acted the title role, and started Hebbel on the road to success. Soon after his prosperity began, the writer received a traveling scholarship from the king of Denmark, which enabled him to spend some time traveling in France and Italy. At that time the duchy of Holstein, in which he was born, belonged to Denmark, though it later became a part of Prussia. After returning home from his travels, he settled in Vienna, where he married a wealthy actress.

Among Hebbel's early plays are "Mary Magdalen," "Herodes and Mariamne" and "Gyges and his Ring." The last named is generally called his masterpiece. This is an excellent example of the author's dramatic genius.

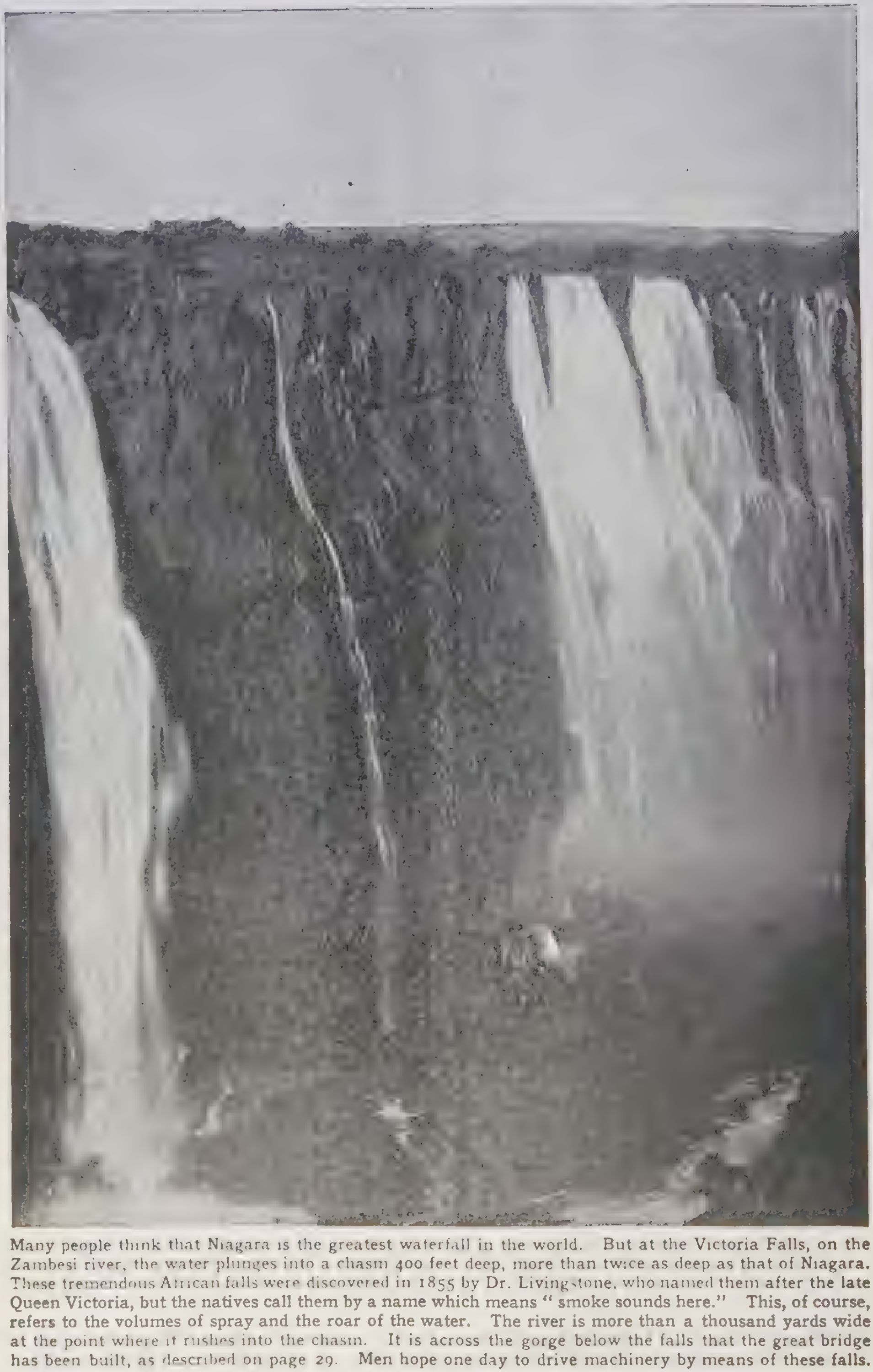
Hebbel died in 1863. The last seven years of his life were devoted to the play "The Nibelungs," which has been made famous by the immortal composer Richard Wagner.

There is another writer whom some students of German literature think is as great as many of these we have mentioned. This is Gustav Freytag, a busy editor who also wrote novels, plays and essays. He was born at Kreuzberg, Silesia, in 1816, and studied at the University of Breslau, and then at Berlin. For a little while he lectured on German literature at Breslau, but was not happy as a teacher, and went to Leipzig to become an editor. The first work which attracted attention was a play, "The Journalists," which he published in 1853. It is still acted, and is often read by pupils studying the German language in our schools. Two years later "Debit and Credit," his greatest novel, was published. He also wrote critical and historical essays, was elected to the North German legislature, and accompanied the Crown Prince of Prussia in the Franco-Prussian War. After this he wrote six novels intended to be a sort of history of the German people, and also did much writing for a weekly paper. After a long and busy life he died in 1895.

These are some of the greatest German writers of the past. There are many writers of many kinds who now write in the German language, and perhaps some of them deserve to be mentioned. It is difficult, however, to fix the place for men of our own time, and so we have mentioned those whom all agree are great.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 3561.

A RIVER THAT FALLS 400 FEET



Many people think that Niagara is the greatest waterfall in the world. But at the Victoria Falls, on the Zambesi river, the water plunges into a chasm 400 feet deep, more than twice as deep as that of Niagara. These tremendous African falls were discovered in 1855 by Dr. Livingstone, who named them after the late Queen Victoria, but the natives call them by a name which means " smoke sounds here." This, of course, refers to the volumes of spray and the roar of the water. The river is more than a thousand yards wide at the point where it rushes into the chasm. It is across the gorge below the falls that the great bridge has been built, as described on page 29. Men hope one day to drive machinery by means of these falls.

A FAMOUS POEM BY MATTHEW ARNOLD

MATTHEW ARNOLD, if not in the very first rank of English poets, is still to be regarded as one of the greater of the modern writers. In his character he reminds us somewhat of Charles Kingsley, as a lover of all that was manly, pure, and of good repute. He wrote many books, but chiefly in the realm of criticism, on which his fame is largely founded, although there are some who think his beautiful and inspiring poems will outlast his brilliant criticisms of literature and religion. The eldest son of Dr. Arnold, of Rugby, one of England's most famous schoolmasters, he was born on December 24, 1822, and died on April 15, 1888. Most of his active life was spent as an inspector of schools, but for ten years he was also Professor of Poetry at Oxford. The poem we give here is one of his most delicate and fanciful pieces, and, although it is addressed to children, it will charm and interest us long after our childhood days are past.

THE FORSAKEN MERMAN

CONTINUED FROM 3319

COME, dear children, let us away;
Down and away below.
Now my brothers call from the bay;
Now the great winds shoreward blow;
Now the salt tides seaward flow;
Now the wild white horses play,
Champ and chafe and toss in the spray.
Children dear, let us away.
This way, this way!

Call her once before you go—
Call once yet.
In a voice that she will know:
"Margaret! Margaret!"
Children's voices should be dear
(Call once more) to a mother's ear;
Children's voices, wild with pain—
Surely she will come again.
Call her once and come away,
This way, this way!
"Mother dear, we cannot stay.
The wild white horses foam and fret."
Margaret! Margaret!

Come, dear children, come away down.
Call no more.
One last look at the white-wall'd town,
And the little grey church on the windy shore,
Then come down.
She will not come though you call all day.
Come away, come away!

Children dear, was it yesterday
We heard the sweet bells over the bay?
In the caverns where we lay,
Through the surf and through the swell,
The far-off sound of a silver bell?
Sand-strewn caverns, cool and deep,
Where the winds are all asleep;
Where the spent lights quiver and gleam;
Where the salt weed sways in the stream;
Where the sea-beasts, ranged all round,
Feed in the ooze of their pasture-ground;
Where the sea-snakes coil and twine,
Dry their mail and bask in the brine;
Where great whales come sailing by,
Sail and sail, with unshut eye,
Round the world for ever and aye?
When did music come this way?
Children dear, was it yesterday?

Children dear, was it yesterday
(Call yet once) that she went away?
Once she sate with you and me,
On a red gold throne in the heart of the sea,
And the youngest sate on her knee.
She comb'd its bright hair, and she tended it well,
When down swung the sound of a far-off bell.
She sigh'd, she look'd up through the clear green sea.
She said: "I must go, for my kinsfolk pray
In the little grey church on the shore to-day.
'Twill be Easter-time in the world—ah me!
And I lose my poor soul, Merman, here with thee."
I said: "Go up, dear heart, through the waves.
Say thy prayer, and come back to the kind sea-caves."
She smiled, she went up through the surf in the bay.
Children dear, was it yesterday?

Children dear, were we long alone?
"The sea grows stormy, the little ones moan.
Long prayers," I said, "in the world they say.
Come," I said, and we rose through the surf in the bay.
We went up the beach, by the sandy down
Where the sea-stocks bloom, to the white-wall'd town.
Through the narrow paved streets, where all was still,
To the little grey church on the windy hill.
From the church came a murmur of folk at their prayers,
But we stood without in the cold blowing airs.
We climb'd on the graves, on the stones worn with rains,
And we gazed up the aisle through the small leaded panes.
She sate by the pillar; we saw her clear:
"Margaret, hist! come quick, we are here!
Dear heart," I said, "we are long alone.
The sea grows stormy, the little ones moan."
But, ah! she gave me never a look,
For her eyes were seal'd to the holy book!
Loud prays the priest; shut stands the door.
Come away, children, call no more!
Come away, come down, call no more!

Down, down, down!
Down to the depths of the sea!
She sits at her wheel in the humming town,
Singing most joyfully.
Hark what she sings: "O joy, O joy,
For the humming street, and the child with its toy,
For the priest, and the bell, and the holy well,
For the wheel where I spun,
And the blessed light of the sun!"
And so she sings her fill,
Singing most joyfully,
Till the spindle falls from her hand,
And the whizzing wheel stands still.
She steals to the window, and looks at the sand;
And over the sand at the sea;
And her eyes are set in a stare;
And anon there breaks a sigh,
And anon there drops a tear,
From a sorrow-clouded eye,
And a heart sorrow-laden,
A long, long sigh,
For the cold, strange eyes of a little Mermaiden,
And the gleam of her golden hair.

Come away, away children;
Come children, come down!
The hoarse wind blows coldly;
Lights shine in the town.
She will start from her slumber
When gusts shake the door;
She will hear the winds howling,
Will hear the waves roar.
We shall see, while above us
The waves roar and whirl,
A ceiling of amber,
A pavement of pearl.
Singing: "Here came a mortal,
But faithless was she!
And alone dwell for ever
The kings of the sea."

But, children, at midnight,
When soft the winds blow;
When clear falls the moonlight,
When spring-tides are low;
When sweet airs come seaward
From heaths starr'd with broom,
And high rocks throw mildly
On the blanch'd sands a gloom;
Up the still, glistening beaches,
Up the creeks we will hie,
Over banks of bright seaweed
The ebb-tide leaves dry.
We will gaze from the sand-hills
At the white, sleeping town,
At the church on the hillside—
And then come back down.
Singing: "There dwells a loved one,
But cruel is she!
She left lonely for ever
The kings of the sea."

CHERRY RIPE

This little lyric in praise of "Julia's" smiling lips was written by Robert Herrick, who was born in 1591, and died in 1674.

CHERRY ripe, ripe, ripe, I cry,
Full and fair ones—come and buy;
If so be you ask me where
They do grow—I answer, There,
Where my Julia's lips do smile—
There's the land, or cherry-isle;
Whose plantations fully show
All the year where cherries grow.

THE LARK

Some of the most delightful writing of the age of Shakespeare, and the age which followed him, is found in the songs that were scattered through the plays of the period. This is an example from Thomas Heywood's "Lucreece," written in 1608.

PACK clouds away, and welcome day,
With night we banish sorrow:
Sweet air blow soft, mount lark aloft,
To give my love good-morrow:
Wings from the wind to please her mind,
Notes from the lark I'll borrow:
Bird, prune thy wing, nightingale sing,
To give my love good-morrow.
To give my love good-morrow,
Notes from them all I'll borrow.

Wake from thy nest, robin red-breast,
Sing, birds, in every furrow;
And from each hill let music shrill
Give my fair love good-morrow.
Blackbird and thrush in every bush,
Stare, linnet, and cock-sparrow,
You pretty elves, amongst yourselves,
Sing my fair love good-morrow.
To give my love good-morrow,
Sing, birds, in every furrow.

MY OLD KENTUCKY HOME, GOOD-NIGHT

This dear old folk-song of the South is well known throughout our broad land, and its author, Stephen Collins Foster, has written many such poems, whose homely sentiment has found for them a place in our hearts.

THE sun shines bright in the old Kentucky home;
'Tis summer, the darkeys are gay;
The corn-tops ripe, and the meadow's in the bloom,
While the birds make music all the day.
The young folks roll on the little cabin floor,
All merry, all happy and bright;
By-'n-by hard time comes a-knocking at the door;
Then my old Kentucky home, good-night.
Weep no more, my lady,
O, weep no more to-day,
We will sing one song for the old Kentucky home,
For the old Kentucky home, far away.

They hunt no more for the 'possum and the coon,
On the meadow, the hill and the shore;
They sing no more by the glimmer of the moon,
On the bench by the old cabin door.
The day goes by like a shadow o'er the heart,
With sorrow, where all was delight;
The time has come when the darkeys have to part:
Then my old Kentucky home, good-night.

The head must bow, and the back will have to bend,
Wherever the darkey may go;
A few more days, and the trouble all will end
In the field where the sugar-canes grow.
A few more days for to tote the weary load:
No matter, 't will never be light;
A few more days till we totter on the road:
Then my old Kentucky home, good-night.
Weep no more, my lady,
O, weep no more to-day;
We will sing one song for the old Kentucky home,
For the old Kentucky home, far away.

IF WE HAD BUT A DAY

"If We Had But a Day" was written by Mary Lowe Dickinson. How many of us have ever thought before how we would spend the time if we had but one day in which to live?

WE should fill the hours with the sweetest things,
If we had but a day;
We should drink alone at the purest springs
In our upward way;
We should love with a lifetime's love in an hour
If the hours were few;
We should rest, not for dreams, but for fresher power
To be and to do.

We should waste no moments in weak regret
If the day were but one;
If what we remember and what we forget
Went out with the sun;
We should be from our clamorous selves set free
To work or to pray,
And to be what the Father would have us be,
If we had but one day.

SHE WALKS IN BEAUTY

Lord Byron, in this poem, gives one of the most charming descriptions of a beautiful woman that has ever been written.

SHE walks in beauty like the night
Of cloudless climes and starry skies,
And all that's best of dark and bright
Meet in her aspect and her eyes;
Thus mellow'd to that tender light
Which heaven to gaudy day denies.

One shade the more, one ray the less,
Had half impaired the nameless grace
Which waves in every raven tress
Or softly lightens o'er her face,
Where thoughts serenely sweet express
How pure, how dear their dwelling-place.

And on that cheek, and o'er that brow
So soft, so calm, yet eloquent,
The smiles that win, the tints that glow,
But tell of days in goodness spent—
A mind at peace with all below,
A heart whose love is innocent.

SHE WAS A PHANTOM OF DELIGHT

Contrast these lines by William Wordsworth with those by Lord Byron. Both treat of the same subject, a lovely woman, and yet note how differently each poet approaches his theme.

SHE was a phantom of delight
When first she gleam'd upon my sight;
A lovely apparition sent
To be a moment's ornament;
Her eyes as stars of twilight fair;
Like twilight's, too, her dusky hair;
But all things else about her drawn
From May-time and the cheerful dawn;
A dancing shape, an image gay,
To haunt, to startle, and waylay.

I saw her upon nearer view,
A spirit, yet a woman, too.
Her household motions light and free,
And steps of virgin liberty;
A countenance in which did meet
Sweet records, promises as sweet;
A creature not too bright or good
For human nature's daily food,
For transient sorrows, simple wiles,
Praise, blame, love, kisses, tears, and smiles.

And now I see with eye serene
The very pulse of the machine;
A being breathing thoughtful breath,
A traveller between life and death;
The reason firm, the temperate will,
Endurance, foresight, strength, and skill;
A perfect woman, nobly plann'd
To warn, to comfort, and command;
And yet a spirit still, and bright,
With something of an angel light.

WILLIAM THE CONQUEROR

Charles Mackay, in these verses, illustrates that side of a great warrior's life which the historians often neglect. We are not to suppose that William the Conqueror thought what the poet here suggests, but we know that with all his conquests he was not contented, and that probably some of the Saxon peasants whom he despised were happier than he was.

GREAT King William spread before him
All his stores of wealth untold—
Diamonds, emeralds, and rubies,
Heaps on heaps of minted gold.
Mournfully he gazed upon it
As it glittered in the sun,
Sighing to himself, "Oh, treasure,
Held in care, by sorrow won!
Millions think me rich and happy;
But, alas! before me piled,
I would give thee ten times over
For the slumbers of a child."

Great King William from his turret
Heard the martial trumpets blow;
Saw the crimson banners floating
Of a countless host below;
Saw their weapons flash in sunlight,
As the squadrons trod the sward;
And he sighed, "Oh, mighty army,
Hear thy miserable lord;
At my word thy legions gather,
At my nod thy captains bend;
But with all thy power and splendour,
I would give thee for a friend!"

Great King William stood on Windsor,
Looking from its castled height
O'er his widespread realm of England
Glittering in the morning light;
Looking on the tranquil river
And the forest waving free;
And he sighed: "Oh, land of beauty,
Fondled by the circling sea,
Mine thou art, but I would yield thee
And be happy could I gain,
In exchange, a peasant's garden,
And a conscience free from stain."

THE BUGLE

This beautiful poem written by Lord Tennyson is taken from "The Princess." The rhythm so perfectly expresses the dying of the echoes into the distance, that we can almost hear them as they grow gradually fainter and fainter until all is quiet.

THE splendour falls on castle walls
And snowy summits old in story:
The long light shakes across the lakes
And the wild cataract leaps in glory.
Blow, bugle, blow, set the wild echoes flying,
Blow, bugle; answer, echoes, dying, dying, dying.

Oh, hark! Oh, hear! How thin and clear,
And thinner, clearer, farther going!
O sweet and far, from cliff and scar,
The horns of Elfland faintly blowing!
Blow, let us hear the purple glens replying:
Blow, bugle; answer, echoes, dying, dying, dying.

O love, they die in yon rich sky,
They faint in hill or field or river;
Our echoes roll from soul to soul,
And grow for ever and for ever.
Blow, bugle, blow, set the wild echoes flying,
And answer, echoes, answer, dying, dying, dying.

THE FAIRY TEMPTER

Samuel Lover, the Irish poet and novelist, is the author of this charming fairy poem. It is a beautiful fancy, with a lesson for all of us—not to be tempted by fair promises from the path of duty, which is always plain if not always inviting.

A FAIR girl was sitting in the greenwood shade,
List'ning to the music the spring birds made;
When sweeter by far than the birds on the tree
A voice murmured near her: "Oh, come, love, with me—
In earth or air,
A thing so fair
I have not seen as thee!
Then come, love, with me.

"With a star for thy home, in a palace of light,
Thou wilt add a fresh grace to the beauty of night;
Or, if wealth be thy wish, thine are treasures untold,
I will show thee the birthplace of jewels and gold—
And pearly caves
Beneath the waves—
All these, all these are thine,
If thou wilt be mine."

Thus whispered a fairy to tempt the fair girl,
But vain was the promise of gold and of pearl;
For she said: "Tho' thy gifts to a poor girl were dear,
My father, my mother, my sisters are here—
Oh, what would be
Thy gifts to me
Of earth, and sea, and air,
If my heart were not there?"

THE MOTHER TO HER INFANT

We have already read a number of short pieces by Thomas Miller on the sights and sounds of natural life. In the following his theme is taken from human nature, and he touches a familiar domestic subject with real feeling.

SLUMBER, my darling, no danger is near,
Thy mother sits by thee to guard thy repose;
Though the wind roars aloud, not a breath reaches here,
To shake the white curtains which round thee do close:
Then slumber, my darling, and sleep without fear,
Thou art safe from all danger, my dearest, while here.

What is it the angels do unto thee say,
When thou dost lie smiling so sweet in thy sleep?
Are they trying, my sweetest, to lure thee away,
And leave me alone in my sorrow to weep?
Oh, sometimes I fancy they whisper thy name,
And would fain bear thee back to the land whence they came.

Then never, my darling, when thou growest old,
Forget her who on thy sweet infancy smiled,
To whom thou wert dearer than jewels and gold,
Who studied thy looks and thy wishes, my child,
Who, when thou didst need her, was never away,
In health or in sickness, by night or by day.

THE SNOW-STORM

ANNOUNCED by all the trumpets of the sky,
Arrives the snow, and, driving o'er the fields,
Seems nowhere to alight: the whited air
Hides hills and woods, the river, and the heav'n,
And veils the farm-house at the garden's end.
The sled and traveller stopped, the courier's feet
Delayed, all friends shut out, the house-mates sit
Around the radiant fireplace, enclosed
In a tumultuous privacy of storm.

Come see the north wind's masonry.
Out of an unseen quarry evermore
Furnished with tile, the fierce artificer
Curves his white bastions with projected roof
Round every windward stake, or tree, or door.
Speeding, the myriad-handed, his wild work
So fanciful, so savage, naught cares he
For number or proportion. Mockingly,
On coop or kennel he hangs Parian wreaths;
A swan-like form invests the hidden thorn;
Fills up the farmer's lane from wall to wall,
Maugre the farmer's sighs; and at the gate
A tapering turret overtops the work.
And when his hours are numbered, and the world
Is all his own, retiring as he were not,
Leaves, when the sun appears, astonished Art
To mimic in slow structures, stone by stone,
Built in an age, the mad wind's night-work,
The frolic architecture of the snow.

RALPH WALDO EMERSON.

YOUNG AND OLD

Charles Kingsley in these oft-quoted verses sets down a whole lifetime of experience. By the quick contrast of the gay days of youth and the grey days of later life he conveys a feeling no amount of prose writing could express.

WHEN all the world is young, lad,
And all the trees are green;
And every goose a swan, lad,
And every lass a queen;
Then hey for boot and horse, lad,
And round the world away;
Young blood must have its course, lad,
And every dog his day.

When all the world is old, lad,
And all the trees are brown;
And all the sport is stale, lad,
And all the wheels run down;
Creep home, and take your place there,
The spent and maimed among;
God grant you find one face there
You loved when all was young.

SOUND LOUD THE CLARION

These four lines of verse by the great Sir Walter Scott are frequently quoted and well worth committing to memory.

SOUND, sound the clarion, fill the fife!
To all the sensual world proclaim,
One crowded hour of glorious life
Is worth an age without a name.

LITTLE VERSES FOR VERY LITTLE PEOPLE

THE sun, one fine evening, on high
Had a side-slip and vanished, oh, my!
I know that it did,
For it left where it slid
Such a long golden streak in the sky.

OH, ring the bells! Oh, ring the bells!
We bid you, sirs, good-morning;
Give thanks, we pray—our flowers are gay,
And fair for your adorning.

Oh, ring the bells! Oh, ring the bells!
Good sirs, accept our greeting;
Where we have been, the woods are green,
So, hey, for our next meeting.

Then ring the bells! Then ring the bells!
For this fair time of Maying;
Our blooms we bring, and while we sing,
Oh, hark to what we're saying.

Oh, ring the bells! Oh, ring the bells!
We'll sing a song with any;
And may each year bring *you* good cheer,
And each of *us* a penny.

"SHALL I sing?" says the Lark,
"Shall I bloom?" says the Flower;
"Shall I come?" says the Sun,
"Or shall I?" says the Shower.

Sing your song, pretty Bird,
Roses, bloom for an hour;
Shine on, dearest Sun,
Go away, naughty Shower.

"BARBER, barber, shave a pig,
How many hairs will make a wig?"
"Four and twenty, that's enough."
Give the barber a pinch of snuff.

"AND, pray, who are you?"
Said the Violet blue
To the Bee, with surprise
At his wonderful size,
In her eye-glass of dew.

"I, madam," quoth he,
"Am a Treasury Bee,
Collecting the tax
On honey and wax.
Have you nothing for me?"

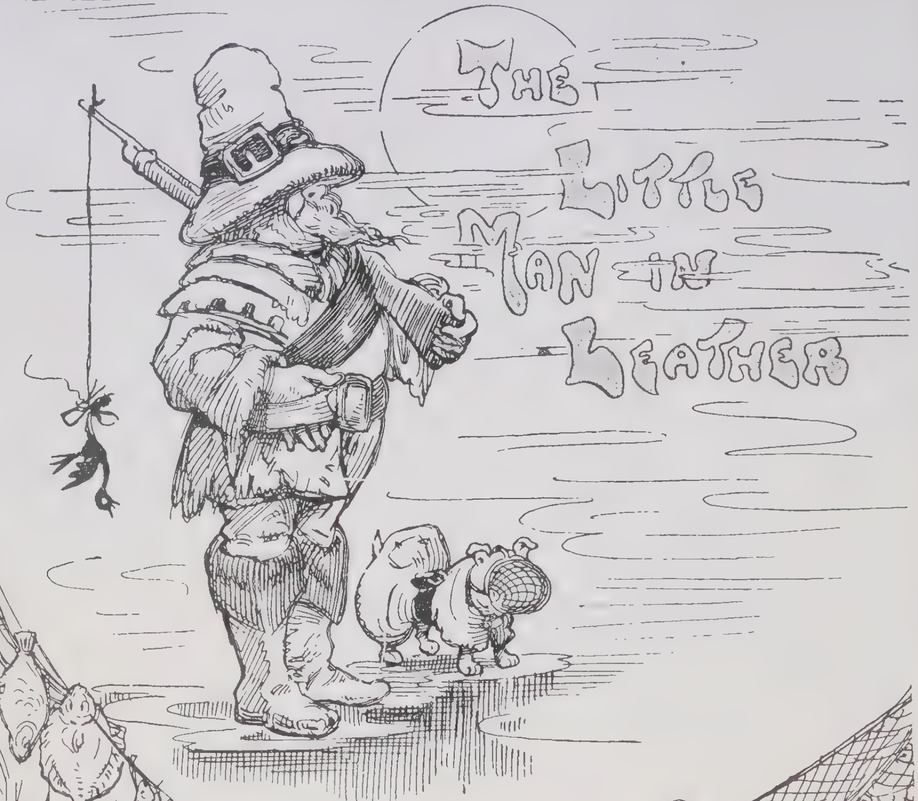
"BILLY, Billy, come and play,
While the sun shines bright as day."
"Yes, my Polly, so I will,
For I love to please you still."
"Billy, Billy, have you seen
Sam and Betsy on the green?"
"Yes, my Poll, I saw them pass,
Skipping o'er the new-mown grass."
"Billy, Billy, come along,
And I will sing a pretty song."
"Oh, then, Polly, I'll make haste,
Not one moment will I waste,
But will come and hear you sing,
And my fiddle I will bring."

TWO frogs fell into a milk-pail deep,
Croak, croak!
And one poor frog did nothing but weep
Croak, croak!
He sank to the bottom as heavy as lead,
Croak, croak!
And there in the morning they found him dead.
Croak, croak!
The other frog shouted: "I'll have a good try."
Croak, croak!
"The pail may be deep, but I don't wish to die."
Croak, croak!
He churned up the milk with his legs fore and hind,
Croak, croak!
There's nothing like having a masterful mind.
Croak, croak!
For when the next morning this froggy was found,
Croak, croak!
On a pat of fresh butter he floated around.
Croak, croak!

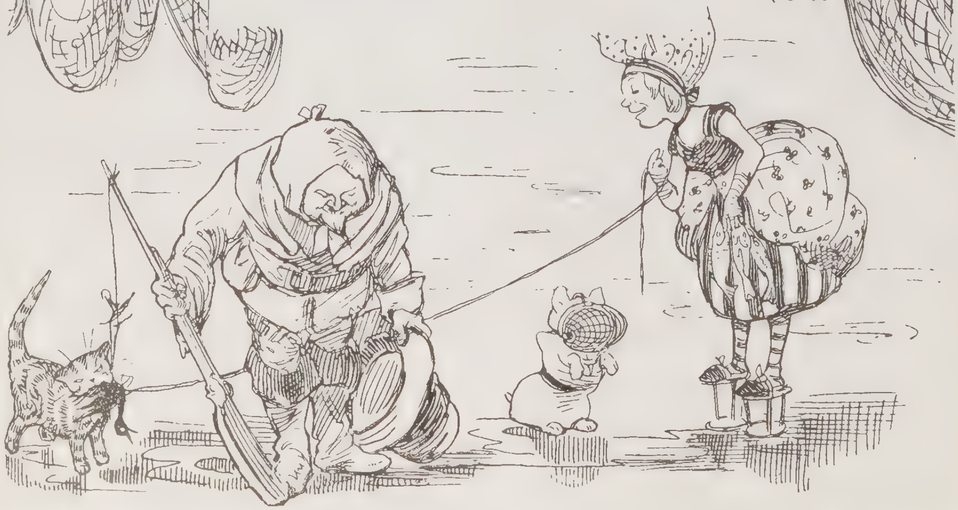
A CUCKOO went back in his clock,
And shut himself up with a shock:
"I'll not strike any more,
I won't open my door;
If they want me," he said, "they can knock!"

THE robin and the red-breast,
The robin and the wren;
If ye take from their nest,
Ye'll never thrive again!

The robin and the red-breast,
The martin and the swallow;
If ye touch one of their eggs,
Bad luck will surely follow.



One moisty morning,
When cloudy was the weather,
I met a little man
Clothed all in leather;
Clothed all in leather,
With a strap below his chin.
How do you do? And how do you do?
And how do you do again?



WHAT THESE PICTURES SHOW US

WHEN you write letters to your little friends, have you thought how wonderful it is that all you have to do is to put a stamp on the letter and drop it into a box? The little green post-boxes in the streets are like fairies' houses: if you post your letter in them you may be quite certain that it will find your friend. It does not matter where your friend lives—whether across the sea in a far-off country, in a little village or in a great town. If the magic stamp is on the letter, the letter will find its way to the right place. The postman is one of the real fairies of the world, and we read here the way in which he sends our letters on their journeys through the world.

HOW OUR LETTERS COME TO US

CONTINUED FROM 3112

WHEN we drop a letter into the box at the corner of the street, or into a little window at the post office, with a comfortable feeling that "the government" will take care of it, we sometimes wonder how "the government" will take care of it. To-day, therefore, we are going to read about the adventures of the letters that drop helter-skelter into that self-same box, and find out for ourselves how it is that they are sent, with the unerring flight of an arrow, straight to their destination.

For some time letters had been dropping into the dark interior of the post box in a great city, at a corner where two streets meet. At first they came slowly, but as the time when the postman came to empty the box drew near, they followed one another thick and fast, like falling leaves on an autumn day. At the last moment, a boy rushed up, and in his haste dropped his letters face downward on the muddy street, picked them up and thrust them in the box in such a state that, if they could, the other letters within would have shrunk from them with horror.

Presently, punctual to the minute, the gray-clad postman, faithful representative of the government, appeared. With his key he unlocked the box, swept the letters in a confused heap into the pouch which hung suspended from his shoulder, and then trudged away. Box after box was unlocked and swept clear of its contents, and when his appointed round was completed he carried the now heavy bag to the post office, and gave up his charge.

HOW THE STAMPS ON OUR LETTERS ARE CANCELED

At the post office the bag was unlocked and its contents with that of many other bags just like it were poured into chutes down which they slipped to long iron tables in a room below. There they were seized upon by men who, as they gathered them up, turned the envelopes so that the stamps faced all one way. When this was done they were packed by a mechanical contrivance in orderly rows on the table of an electrical machine. The man at this machine rushed the letters through it, and when they came out, each one bore on its face the wavy line which cancels the postage stamp and a round stamp with the date of the month and year and the name of the post office.

As fast as the letters came out of the canceling machine, they were gathered together and given to men who rapidly sorted them to see whether the address said they were to be sent to some one in the city or in the state, to some one in another state, or to some one living in a foreign country.

After the letters had gone through

THE STORY OF THE GREEN MAIL BOX

When you post a letter to your friend in this letter-box you need have no fear. The letter will find its way safely to any part of the world. Letters in this box may go to India, Japan, France, Chile, or round the corner.

Nobody but the postman can touch the letter after you have posted it. The postman clears the box, and carries the letters in his bag to the post office, where they will be started on the way to their owners.

This is a scene in a large post office after the receipt of letters which have come from another city. Mail bags are being brought to the table, where the contents of other bags have been piled already. You may notice the bundles which were tied in the post office, where the letters were mailed, or in the mail cars.

HOW THE MAIL TRAVELS

This is one of the fast trains running at full speed on its way from New York to Chicago in less than twenty-four hours. It stops for passengers only at the largest cities, and the change of engines is made in a few minutes. Our grandfathers spent weeks on this journey, now made with comfort in less than a day and a night. Sometimes trains carry nothing but mail cars, and run at high speed.

This is the interior of a mail car on a long run. This car carries mail for distant points, and here you see the clerks, who are employed by the government, distributing it into proper sacks, which are held open before them. They grow so expert that they almost never throw a piece into the wrong sack.

Pictures by courtesy of the New York Central Lines.

this first sorting, they were taken to the men at the final sorting racks. Standing in front of the rack, made, for instance, to hold the Pennsylvania letters, a man picked up bundle after bundle of letters and with great rapidity sorted them into the pigeonholes marked with the names of the post offices corresponding to the addresses on the envelopes. When this was done, the letters were tied in bundles, and they were then ready for the waiting mail bags.

Each bag had a tag which showed the time at which its train would leave. As that time drew near, the bag was locked, and with numbers of others it was loaded on a truck and sent off to the railway station.

The same thing was being done at the same time, by other men, for the letters from our box which were to be sent to every other state in the Union, to Canada, to Europe, even to far-away corners in little known parts of the world. Some of the letters had to wait for a ship to take them on their way. Some of them would take months to reach their destination, and might make the last part of their journey in a bullock cart in India, some of them might be carried to their owners by Kaffir runners in Africa. Perhaps the bags that had just reached the post office from a great liner held letters that had been carried on the first steps of their long journey in the same primitive way.

HOW OUR LETTERS SHOULD BE ADDRESSED

Most of the letters, of course, were neatly and carefully addressed, with the stamp put straight and square in the right hand corner of the envelope. These all passed through the hands of the sorters with extreme rapidity. A few letters, however, were not sufficiently addressed, or the writing was so bad that the sorters could not stop to read it without delaying the rest of the mail, and on some of them the stamp had been carelessly stuck in the wrong place and had not been touched by the canceling machine. These were tossed aside to be picked up by another man who cancels the postage stamp with a hand stamp or reads the badly written address, and sends the letters with insufficient addresses to the Dead Letter Office, unless indeed they have return addresses on them, when of course they are returned to the writer. All this took time. Some of the carelessly addressed letters missed the first mail, and so you see it is worth while to take the trouble to address a letter with care.

At last we hear the postman's knock, and our little friend receives her letter. It has come safely home after many exciting adventures by land and sea, and we may be sure that it is opened with great delight.

So far, we have thought only of the letters which were addressed to out of town places. Now we must come back to the letters which bore city addresses. As fast as these letters could be sorted they were packed in steel cylinders. A man slipped the cylinders into a pneumatic tube, and off they went, driven by compressed air, through a little subway, to the next branch station. There a man, stationed at the tube, picked out the cylinders meant for his own post office and sent the others on their way. Thus they went from station to station until the last one reached its journey's end. It is fascinating to watch the tubes open and the cylinders slide out swiftly and quietly on their steel tables as if they knew they had come home to rest. These tubes are built only in very large cities such as New York, Chicago, San Francisco, however. In most places the letters are locked up in a post office wagon and sent to the branch office to be sorted by the letter carriers. Some letters are meant for the district to which the post office belongs, and these are sorted out according to their street addresses by the letter carriers, who drop them into their pouches and tramp off on their rounds, carrying messages of sorrow or of joy.

PARCELS AND LETTERS IN THE POST OFFICE

This picture shows the work of the men who sort parcels. If the picture were large enough you could see that each of the slides is marked with the name of a state or of one of the large cities. At the back of each slide there is a wire door. When the receptacle is full, a man hooks a strong bag on the frame, opens the door, and the packages fall into the bag held ready for them. Large packages are sent on mail trains.

These are the steel cylinders in which letters are sent between the general post office and the principal branch offices in some of our large cities. When a cylinder is full, it is locked, placed in a pneumatic tube, and sent off on its journey in the way described on page 3410. They travel very rapidly through the tubes.

Now let us go back to the bags which the train is bearing out of the city, for there is much work still to be done for the letters in those bags before they are delivered to their owners in the places to which they are addressed.

HOW, AS THEY ARE CARRIED THROUGH THE COUNTRY, THE MEN WORK

You remember that we stood for a moment beside the man who sorted the letters for Pennsylvania. Now that man, and other men like him, sorted all the letters that they found addressed to Philadelphia by themselves. The man who filled the bags put them into a sack marked for that city. This was not opened until it reached Philadelphia, but there the letters had again to go through a process of sorting. Some of them were addressed to small offices around Philadelphia. The man who filled the bags knew that the quickest way to send them was to let them go to Philadelphia first. So he put these letters also into a bag to be sorted by the postmen there. Now many towns and villages in Pennsylvania lie between Philadelphia and our post office and it would be a great waste of time if all the letters had to be sent to the city and back again. But on each mail train there is a traveling post office. As the train rushes through the country, the clerks in this post office are busy sorting letters from the great sacks into smaller bags. Some of the bags are meant for the small towns on the line; some of them are transferred to other trains on branch lines; some of them may even be made ready to send out on a route of the rural free delivery.

This work goes on ceaselessly on every mail train that runs out of our cities. Town after town, village after village, receives its bag of letters from the tireless clerks on board the post office on wheels. Very often no stop is made. As the train comes to the station at almost full speed, a clerk standing at the side door of the car throws the locked mail bag to the platform, to be taken away by the man who is waiting there. This man brings with him the letters to be sent on the train; but as the train cannot stop, he hangs his bag on a crane set up in the station for that purpose. As the train passes, an iron arm shoots out from the open door, catches the bag, and gathers it into the car.

Not only letters, but newspapers, magazines, periodicals of all sorts are carried in mail bags on trains. Parcels, too, are carried by the mails. Produce from the farm may be sent to the city, and in return the city merchant may send his goods to the farmer. Large packages are not now put on the fast mail trains. They are sent on freight trains, because it has been found that it cost the railways too much to carry them on passenger trains.

WHAT IS MEANT BY RURAL FREE DELIVERY

Not very long ago, letters were collected and delivered by postmen only in large places. Everywhere, outside of the cities, letters had to be carried to the post office itself by the writers, and called for by the owners. Now, however, in many places we have what is called "rural free delivery." Mail carriers drive or ride through the country to collect the letters written, and to leave those that have been brought in to the office by the train or other conveyances. This system is a great convenience to dwellers in country places.

If we pay a few cents more than the ordinary postage rate for a letter or parcel the government will register the letter or insure the parcel, and obtain a receipt from the person to whom it is delivered. In such a case, the letter or parcel may be traced unerringly from the beginning of its journey to the very end.

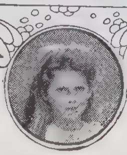
As we look round the great post office, of which we have been speaking, we think of all the places from which the letters come that pour into it every hour of the day. They have come from western ranches, from lonely mountain farms, from small hamlets, large towns, great cities. They have been carried on horseback; in mule wagons; in jitney busses; by train; in canoes; in river steamboats; in great ocean liners.

It costs only a few cents to send a letter from one part of the country to the other; or from our own country to the other side of the world. Of course, if we had to pay the actual cost of sending our own letters, no one could write any letters at all. That is why the government undertakes to send them for us. A few cents paid on each of many thousands of letters provides the cost of sending the huge masses of mail of which we have been thinking.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 3479.

TEA, COFFEE, AND TOBACCO

CONTINUED FROM 3275



WE must now discuss a number of substances which are very largely used, but which we cannot call foods because we do not find that they add any power to the body or make any of its tissues. If these things did nothing, they would not be worth mentioning; but though they are not foods, they have a very real action upon the body, and there are few people who do not take one or other of them every day. We ought to understand their action.

First we must just mention, and briefly dismiss, the things called condiments. Literally, this means *the things given with*; and the things that we give ourselves along with our food, and call condiments, are salt, pepper, mustard, vinegar, and so on. Of these, the first happens to be a condiment, as we say, because it has a very decided taste; but we have already learned that it is an absolutely necessary food, without which we must die. But all the other condiments are quite different. They have no food-value of any kind; they may be actually injurious by irritating the coat of the stomach.

This is very rare, but it may happen when a person becomes, for instance, too fond of vinegar. We take these things not only for their own flavor, which we really do not care much about in itself, but because they act on the nerves of the mouth and tongue and nose so as to sharpen the taste and flavor of our food. If our appetite is poor, this is of service to us. Also, these things have a marked effect in persuading the stomach to produce its juices, and, if the stomach is not producing enough, that is also of good service to us. On the other hand, a great many people eat far more than is good for them, and the last thing on earth that they ought to add to their food is anything that tempts them to eat more.

No condiment of any kind, except, of course, salt, as we understand, is good for children. Children have good appetites and good digestions, and condiments should be saved up for the time when they have neither. That time is less likely to come at all if the healthy development of the organs of digestion has not been interfered with by adding unnatural things to the food. As we shall see, this remark about condiments, which is agreed upon by everybody who has studied the food of children, applies also practically to all the other things that have to be discussed in this part of our story.

All over the civilized world people drink enormous quantities of tea or coffee, or else of drinks made from other plants that really contain the same thing for the sake of which we take tea and coffee. Of course, tea and coffee have very different tastes,

and that difference must be due to something. Certain volatile oils occur in the tea-plant which are quite different from those in the coffee-plant. These oils have a very pleasant taste and flavor, but they are not very important in their action on the body. The thing that really gives tea and coffee their attraction is the same substance in both of them, and it exists in several other plants. It is sometimes called *theine*, and sometimes *caffeine*. This is a wonderful substance, and, so far as we know, there is nothing else like it in the world. It is the best stimulant of the brain that has yet been discovered. Other things, such as alcohol, will appear to stimulate the brain, but that is only appearance, as we shall see. Caffeine however, seems to make the brain work better, it produces little reaction afterwards, and because it is a true stimulant of the brain, it is the only drug we know which, by its action on the brain, will keep people awake.

THE STIMULATING DRUG THAT HELPS THE STUDENT TO KEEP AWAKE AT NIGHT

Students working for examinations sometimes take not merely tea or coffee but pure caffeine itself, which is a bitter-tasting white powder; and swallow large doses of it at night in preparing for an examination. I do not say that this is a wise thing to do, but it will keep one awake, it will enable a man to read and work hard for hours when, without it, he could not possibly have kept his eyes open, and the chief result that appears to follow after a long time is that the drug becomes less effective.

All this is not to say that we may not hurt ourselves with tea and coffee, because we often do. For one thing, people who are not working for an examination, and whose difficulty is not to keep awake, but to get to sleep, hurt themselves by taking these things. Bad sleepers ought either to make it a rule to take no tea or coffee after five o'clock, or after midday, or, better still, to go without altogether.

Then, again, many people hurt themselves with tea not because the caffeine does them any harm, but because the tea-leaf contains a great deal of a curious substance called tannic acid, or tannin, which is bad for the digestion. If we put a little pure tannin into the mouth, we can feel at once how it dries the mouth up, and it does the same in the case of the stomach. This means that the digestive juices cannot be properly produced. If we allow for the possible interference with sleep, and for the interference with digestion, we account for the whole of the bad effects that may follow the frequent taking of tea.

THE RIGHT AND THE WRONG WAYS OF MAKING TEA

China tea contains less tannin than other tea; but the really important thing is the way in which tea is made. Careful experiment has shown that in about three minutes boiling water will extract practically all the caffeine in the tea-leaf, together with the flavoring matter. In this period of time little tannin is extracted. If we go on infusing after this, we get nothing more that is pleasant or useful, but we do get more tannin; more and more indeed gets into the water for as long as three-quarters of an hour, and there is far more after five minutes than after three. It is wrong to boil or stew tea. It should be infused, which means that the boiling water should be poured upon it; and it should not be infused a moment longer than four minutes at the outside. The Chinese, to whom we really owe tea, say that the best water with which to make it is that from a running stream, and the worst is well-water. The reason is that one should use water which has plenty of gases in it. If we allow the kettle to go on boiling, we drive off these gases, and make the water flat, and spoil the tea. We should use the water directly the kettle has come to the boil.

THE WAY TO GET THE BEST VALUE INTO A CUP OF TEA

If we have to use water which is flat to begin with, we should pour it from a height, from one jug to another, so that it can take up some of the gases from the air. If the water is hard, a pinch of baking-soda should be added to the teapot. Tea-tasters use a smaller proportion of tea than most of us do. The teapot should be thoroughly hot, for if the water falls much below the boiling point while the infusion is going on, some of the things in the leaves which give the tea its best flavor do not get into the water. We should never make a second brew, for it is

certain that the first brew takes away from the leaves everything worth having. Anyone who cares to attend to these rules about the making of tea will get a far more delicious drink from cheap tea than can be got from tea costing twice as much, but wrongly made.

Let us remember, too, that properly made tea is one of the most innocent drinks in the world, and in many respects, and for most people, is actually beneficial. In our country we drink several million gallons of tea every day, and the small amount of ill-effect that can fairly be put down to this gigantic consumption is chiefly due to the fact that many people are so careless in the way they go about it.

So far as caffeine is concerned, coffee and tea do not differ very much—that is to say, coffee made with milk contains about a grain of caffeine to the cupful, and the rate in tea is about the same. But, of course, if we drink strong black coffee we swallow a good many grains of caffeine every day. There is a special and powerful volatile oil in coffee which upsets some people, so that they cannot drink coffee, though they can drink tea.

THE HARM THAT COMES OF BAD TEA AND BAD COFFEE

Our commonest mistake in making coffee is that we make it too weak. The berries should be freshly roasted, neither too much nor too little, and they should be ground just before they are used. The same rules apply to the water as in the case of tea. Metal apparatus, especially if it is complicated, is bad. It is often difficult to clean, and then the stale coffee spoils the new brew. If the coffee is allowed to stand for a little, there is no need to filter it. A simple earthenware vessel is the best. If anyone finds that he is not sleeping as he ought, and if he is a coffee-drinker, that is the very first thing that he should cut down.

Though black coffee is stronger than tea, it is much less injurious—if injurious at all—than improperly made tea. Hundreds and thousands of girls ruin their digestion by taking tea from a kettle kept on the fire all day; but it is the tannin and not the caffeine that is most to blame. There is not much tannin in the coffee bean. No child should take tea or coffee. I do not say that older children are necessarily hurt by occasionally taking a little very weak tea, but they are safer without it. The bright, active brain of a child always "on the go" has no need to be stimulated; and these things are only stimulants, not foods. Also, in encouraging children to take these things, we interfere with their contentment in taking really important things like milk. Again, many a child who has tea late in the day is found to be excited and unsleepy at night, and the tea is the real reason.

WHY CHILDREN MAY DRINK COCOA FREELY WITHOUT HARM

Cocoa differs from tea and coffee in one or two important ways. It also contains a substance which is closely related to caffeine; but it is so weak a stimulant that it is not worth mentioning, and therefore we may freely permit children to drink cocoa, though we forbid them tea and coffee. This is a very important point, because children like hot things, and hot drinks are often very good for them; and if we flavor hot milk with cocoa, we can persuade them to take it better. It is wonderful how much milk and sugar we can get inside a child with the help of a substance like cocoa.

Many people suppose that cocoa itself is a useful food; but, as a matter of fact, we do not use much cocoa in the cup, and what there is is unimportant as a food. The fat in cocoa, which is useful in its small degree, may upset the digestion, and so many children will not touch cocoa. It is worth knowing that different kinds of cocoa differ a good deal in the way they are made, and the child who refuses to take one kind will perhaps quite readily take another which may, for instance, contain less fat of the bean.

CHILDREN MAY EAT CHOCOLATE FREELY IF THEIR TEETH ARE PROPERLY CARED FOR

To praise cocoa is to praise chocolate, which is a splendid food. When we take chocolate, we are not merely taking solid cocoa, with such food-value as it has, but we are also taking a very large quantity of sugar. The soldiers, when fighting in South Africa, learned how pleasant and how sustaining chocolate is. Most children love chocolate, and are quite right, too. The plain chocolate, which is cheaper, is really better

for children, both as a food and for other reasons, than cream and fancy chocolate bonbons. We often notice that some children are wise enough to prefer plain chocolate to the elaborate and fancy things which tempt their elders. If children's teeth are properly used and properly cared for, the sugar of chocolate need not be feared. Far the finest teeth in the world among human beings belong to negroes, who very nearly live on sugar-cane.

ALCOHOL AND TOBACCO ARE NOT FOODS, BUT POISONS

We have already learned that we are bound to study from the food point of view everything that enters the body, whether it be what we usually call a food, or whether it be a gas, such as the air which we breathe. Many of us are in the habit of taking into our bodies various substances which are not foods, but which we take as if they were foods, and which we certainly ought to understand. The most important of these things are tobacco and alcohol.

Nowadays there are a good many others which a certain number of people take, but we need not discuss them, especially as what is true of tobacco and alcohol is largely true of them. These substances are both poisons; in other words, a sufficiently large dose of them—the exact amount depending upon the weight and age of the particular person, on whether he has taken the drug before, and so forth—will kill. That the smoke of tobacco is a poison no one questions, though a great many people who know nothing about the subject question whether alcohol is a poison. They think it is absurd to call alcohol a poison, because many take it daily without being killed.

THE POISON THAT WILL KILL AND THE POISON THAT WILL NOT KILL

But for every poison in the world there is a dose that will kill and a dose that will not. This is true, for instance, of the carbon dioxide in the air we breathe. Carbon dioxide is a poison, but it will not kill except in the poisonous dose. In lesser doses it merely injures, or else the body resists it altogether, and is not hurt. But when the body has to do this with anything that threatens it, it has to pay a fair price. Tobacco is the leaf of a plant, and this leaf contains various substances, including a special one called *nicotine*, which, when given by itself, is intensely poisonous. It seems to be true of both nicotine and alcohol that they are poisons in their degree to every form of life. A third of a grain of nicotine has killed a man. People who take tobacco may smoke it, or they may chew it, or they may grind it up and take it in the form of snuff. It does not matter for us here in what form the tobacco is taken, for the results are the same. Of course, we understand that when the leaf is burned, great chemical changes must be produced in it.

People have said that the nicotine and the other poisons in tobacco smoke must be burned up, when tobacco is smoked, or oxidized away into carbon dioxide and water. But anyone who tries to smoke a pipe for the first time will soon discover that something very curious gets into his body, and it has been proved conclusively that tobacco smoke *does* contain nicotine.

THE GREAT DANGER OF THE POISONOUS NICOTINE IN TOBACCO

The nicotine is destroyed in the tobacco that is burned, but somewhere between the place where the tobacco burns and the smoker's mouth, the nicotine is made hot and turned into gas and sucked in. If the smoker merely drew nicotine into his mouth, and then puffed it out again, there could be no consequence except upon his mouth itself. The effect of smoking depends not upon what is drawn in, but upon what is absorbed; just as the effect of eating depends not upon what is swallowed, but upon what is absorbed.

However, nicotine is a very volatile, quick substance, and easily passes through the lining of the mouth into the blood. Unwise people sometimes have the trick of breathing tobacco smoke right into their lungs instead of merely sucking it into the mouth and puffing it out again, and they will even teach boys how to inhale the smoke of cigarettes. This is very difficult to stop once we start doing it. It means that far more of the things in the smoke are absorbed, because the whole great surface of the lungs—equal to 2,000 square feet, as we know, if it were spread out—is exposed to the smoke, and it is a surface that is specially made and suited for transferring gases from

one side of it to the other. Also, directly the smoker starts inhaling, this means that the smoke is now passing between his vocal cords, as they are called, with which he speaks or sings. Smoke is crowded with solid particles, which are caught on the vocal cords. Many of the gases in the smoke are very irritating, and all are hot.

HOW TOBACCO SMOKING SPOILS THE VOICE AND ENDANGERS THE LUNGS

Thus, everyone who regularly inhales tobacco smoke is absolutely certain to spoil his voice sooner or later, even if nothing worse happens. It would be very easy to exaggerate the ill-effects of ordinary smoking; but there is a very great difference indeed, as we now understand, between puffing smoke in and out of the mouth, and inhaling it between the vocal cords into the lungs. Anyone who teaches and encourages a boy to do this is not that boy's friend, but his thoughtless and cruel enemy.

Enormous numbers of grown-up people smoke without its being possible for anyone to show that they do themselves any harm. As in the case of many other poisons, the first effects do not return. We have already learned how marvelous is the power of living creatures to adapt themselves to circumstances. So, as a rule, the body learns, in a short time, how to take the gases of the smoke without being upset by them. The scientific way of saying this is that the body acquires *immunity* against the poison. The same applies to many other poisons, such as opium. In the case of opium, and some other poisons, the dose has constantly to be increased. This is not so much noticed in the case of tobacco.

But in the case of all these substances the rule is that at a certain time after we have taken the dose which satisfies us, we find that we want another dose. Certain changes which we are now beginning to understand occur in the body.

WHY A SMOKER BECOMES RESTLESS AND WHY TOBACCO SOOTHES HIM

What happens appears to be that the original poison, such as the nicotine, or the morphia of opium, is broken up inside the body, and another substance is produced which has just the opposite effect upon the body. This may sound peculiar; but, in point of fact, we know scores of plants containing two oppositely acting substances, one of which is derived from the other. So what happens in the case of the smoker is, for instance, that the nicotine forms an "opposite of nicotine," which makes him just a little restless and uneasy; and then when he takes some more nicotine—that is to say, when he smokes again—this makes him feel restful and contented. So there is established what is usually called a "vicious circle." It is very often pointed out, and quite truly, that smoking has a good effect upon a man, because it makes him feel more contented and restful, and improves his temper. Quite so; but we ought to add that the reason why he wanted these things done for him is that his temper and contentment had been upset by the after results of the last time that he smoked.

A man may have smoked for many years, and yet, in only a few days, if he stops altogether, he may lose the craving, just because his body gets rid in that time of the last remains of the things that are made in it which make him want to smoke again. After smoking without a break for fourteen years, the writer has just made this experiment upon himself, and so he knows that what has been said is true.

THE GREAT ADVANTAGE OF NOT SMOKING AT ALL

Most smokers know in their hearts that they smoke too much, and wish to cut down the amount. There are various ways in which they may do this. It is good, for instance, to make a rule about smoking only after meals, or only after a certain hour in the day; or to make a rule of not carrying tobacco about in one's pockets. Many people have found that if they suck strong peppermint lozenges, this helps them to cut down their smoking.

All authorities on the subject will admit that it is best not to learn to smoke at all. No one can call smoking natural; no one can prove that it does any good except to relieve the symptoms which it has itself created, and which the relief of them will again create; and even if there be no injury done to life, which may well happen in cases of tobacco blindness, tobacco heart-weakness, and so on, there is always a certain amount of injury done to the

pocket. But, even supposing that anyone tried to argue that smoking was really a good thing for grown-up people, at any rate no one would dare to argue that it is good for children, or young people of any age or of either sex. No one can say that the child needs the tobacco; and neither can anyone show that the tobacco does the child any good. All the likelihood, of course, is that the developing body will be more injured than the already developed body. That is true without exception of every poison or injurious substance known, and is equally true of all living things, plants, animals, or human beings.

THE THINGS THAT MAKE A MAN AND THE THINGS THAT MAKE A SHEEP

Tobacco being a poison, no boy enjoys his first experience of it. He is encouraged to go on by an argument which would be quite the best argument in all the world if it were true. It is, that he should "be a man." This argument is applied to boys about things far worse than tobacco smoking. The boy is to smoke or drink, or whatever it be, because others who are older than himself do it; and so they say he will prove himself as much a man as they are. The real mark of a man is not that we should smoke, or drink, or shave, or be six feet high; the real mark of a man is to be ourselves, to do things or not to do things because we so think fit; and the mark of not being a man, however old or big we are, is to do things because other people do them. So when they say "be a man," they really mean "be a sheep"; and that is what we should reply in such a case. This is a very important matter, because it applies to many other things besides smoking; and it would be quite important enough even if it only applied to that.

THE KIND OF BOY WHO IS A REAL MAN AND MAKES HISTORY

The writer remembers, as if it were yesterday, his feeling of being grown-up and manly, and as clever as older boys, when he first smoked. No one expects boys to have the sense of men, and it is natural for boys to feel manly in such a case when older boys admire them. But the difference between a real man and a sheep remains; and, if it comes to that, just as a grown-up man can be a sheep, so a boy can be a man at any age, not by making himself feel miserable in doing the things grown-up men do, but by deciding for himself what to do, and what not to do, without reference to foolish people. It is this kind of boy and this kind of man that makes history, that has made the world what it is worth to-day, and will make it worth more in the future.

There has been a good deal of talk in many states during the last few years about this question of children smoking, and it has been agreed by everyone that it ought to be stopped. It is not at all easy to do, because the proper way to do what is needed for children is through their parents, and there are children whose parents do not care—babies in arms whose mothers give them beer to sip, and little schoolboys whose fathers are quite proud to see them smoke a cigarette. However, in England and in some of our states also, laws have been made which deal with children smoking, and which will do something, at any rate, to protect children from themselves and from foolish people in this respect.

THE KNOWLEDGE THAT HELPS US TO DO RIGHT AND ACT WISELY

In some places a child under sixteen found smoking in the street or in a park must be stopped by the policeman or the park-keeper; and any boy so found smoking may have his pockets searched. Tobacconists may be punished if they sell cigarettes to children. No doubt these are proper laws; but we must not forget the usefulness of knowledge, and the wisdom of trying to make people sensible so that they can govern themselves. It is a thousand times better for a boy not to smoke because he has learned about smoking, and has decided that it is more sensible for him, on the whole, not to smoke, than not to smoke because he is never sure whether there is a policeman round the corner. There are always these ways of getting people to act properly, and no doubt the way of compelling them from the outside is often necessary; but the people whose lives are worth most to themselves and to the world are those who have the strength and knowledge to govern themselves wisely from within, and knowledge has its highest value because it helps them to do so.

THE NEXT PART OF THIS IS ON PAGE 3595.

THE NOVELS OF THACKERAY

HAVING read the charming story of "Henry Esmond," we must now read its continuation in "The Virginians." Strictly speaking, the one story is not a "sequel" to the other, as that means a second story in which all the characters of the first reappear, and this is not the case in "The Virginians." Still, it is usually spoken of as a sequel to "Henry Esmond," as several famous characters in that story reappear in "The Virginians," together with their children and grandchildren. Although it is a fine and moving romance, it lacks something of the charm which we find in "Henry Esmond," as George and Harry Warrington, though both manly and lovable characters, have not the splendid qualities of their grandfather, Henry Esmond; while their mother has little of the charm of Lady Castlewood, whose daughter she was. The Castlewoods of the younger generation are also a contemptible set, but Beatrix is, perhaps, more sympathetic in her old age than she was as a young woman.

THE VIRGINIANS

THE STORY OF HENRY ESMOND'S DESCENDANTS

CONTINUED FROM 3314

COLONEL ESMOND had various reasons for leaving England at the close of the reign of Queen Anne. Having become so deeply involved in the Jacobite plots, which were designed to place the son of James II. on the English throne at the death of Queen Anne, but failed for reasons stated in "The History of Henry Esmond," he considered it wise to leave the Old Country. There was also the promise of a new and tranquil life for him in America, wedded to Lady Castlewood, whom he had loved so well and served so loyally. It will be remembered that we left them both happy in their new life in Virginia, where the colonial estates of the Viscount Castlewood, which were Esmond's by right, had been given to him by his stepson, the young viscount.

In the new Castlewood, as they had called their Virginian home in honor of the ancestral mansion in England, a daughter, Rachel, was born to the Esmonds, and she grew up a lively and energetic little woman, immensely proud of her parentage, as she had good reason to be. Like her mother before her, Rachel married at an early age, her husband being the younger son of a Norfolk baronet. His name was George Warrington. They were not fated to enjoy a long married life, and Rachel found herself a widow while still a young woman. She had, however, two sons, George and Harry, who were twins. As George was ushered into the world just half an hour before Harry, he was the heir to the estate; and Harry was taught from his earliest years to respect him as his elder brother. On the death of his dear wife, Colonel Esmond, now well advanced in years, gave over the management of his property to his daughter Rachel, who had shown the most remarkable capacity for the work, and whose business-like energy was known throughout Virginia. She was a little lady with a great belief in her own opinions, and having very rigid ideas of her importance as the daughter of such distinguished parents, she asserted herself to such an extent that, in time, she quarreled with most of her neighbors as well as with her own sons. She even managed to fall out with her relatives in England by means of correspondence! Her husband had been dead but a short time when she gave out that she was to be known as "Madam Esmond," being prouder of her own name than of Warrington, although the latter was not without honor. And on the death of her father she recognized her son George as the heir of the estates, regarding him somewhat in the light of a young king for whom she was playing queen-regent.

When the boys were fourteen years old they were left a legacy of several thousand pounds by an aunt, and the imperious Madam Esmond was greatly annoyed when the London lawyer would not recognize her claim to do with the money as she wished.

She would have kept it all for Harry, and because George sided with the lawyer in thinking it should be divided between them, she reproached him with his meanness, and decided that she would save up for Harry's fortune.

THE WHIMS OF MADAM ESMOND AND THE BROTHERLY LOVE OF HER BOYS

Thus she went on through life: when she was "out" with one she was usually "in" with the other. It was a happy thing that none of their mother's whims affected the brotherly love of the two boys, who were devoted to each other. Harry was the stronger of the two, but as a boy George was quite as mischievous as his brother, and in a quarrel with a dull and prosy tutor named Ward, whom Madam Esmond admired and had appointed over the lads, George was so successful that the tutor had soon to leave, and Madam Esmond realized from that day that there was a master, as well as a mistress, at Castlewood.

Later on, the young master of Castlewood proved that he had inherited something of his mother's hasty temper, when he challenged young Major Washington to a duel, in the belief that the major had made an offer of marriage to the fair mistress of Castlewood.

A gossiping lady companion of hers—Mrs. Mountain—who seemed to think that every bachelor gentleman who visited Castlewood was in love with Madam Esmond, had been responsible for the story, which was quite without truth. Thanks to Harry, who was a great admirer of the young George Washington, the matter was explained, and George apologized.

GEORGE WARRINGTON IS THOUGHT TO HAVE FALLEN IN BATTLE

The efforts of Great Britain to clear the French out of America were now about to be pushed forward with some determination. General Braddock, an officer of great distinction, was sent over to organize the operations against the French. On his staff George Warrington became an officer, and so left home to take part in the fighting. Letters were regularly received from him at Castlewood, and read by Harry to his mother and Mrs. Mountain; but one day came news of the terrible disaster that, as we have learned, had overtaken Braddock's forces, and left the French and their Indian allies for the moment victorious. This news did not come from George, and, fearing he might be among the fallen, Harry set out for the front in the hope of discovering his brother's fate.

The death of Braddock left Dunbar in command of the forces, and to the camp of that commander Harry repaired, having heard that one of Braddock's officers was lying there ill with fever. He found, however, that this was not his brother, but his friend George Washington, now colonel, who could give him no good news of George, and believed him to have perished at the hands of the Indians.

Colonel Washington, on recovering, accompanied Harry back into Virginia, and had the pain of listening to the unreasoning reproaches of Madam Esmond, whose sorrow for the loss of her son, combined with her usual hasty temper, led her to accuse the colonel of having abandoned George to his fate.

WHY HARRY WARRINGTON LEFT VIRGINIA ON A VISIT TO OLD ENGLAND

As a consequence of this, life was gloomy and cheerless on the Virginian estate, and, to make matters worse, so far as Harry was concerned, fever marked him for a victim. When he had recovered sufficiently he was advized to go away on a sea voyage, and thus came the idea of his visiting the old land of England. Soon after he set sail for England, his mother left the plantation for her town house in Richmond, a thriving young colonial town, where she set up her little throne to continue her harmless amusement of playing the part of queen over the local colonial society.

It was in the summer of 1756 that Harry Warrington arrived in England, accompanied by his negro servant, Gumbo, and took coach from the port of Bristol to Castlewood House in Hampshire, the ancient home of his grandfather's family. Times had changed greatly at this old Castlewood. Harry's Uncle Frank, for whose sake Colonel Esmond had not asserted his undoubted right to the title and estates, was dead,

The baroness showed Harry the portrait of a lovely young woman in the dress of Queen Anne's days, and said: "Harry, that was my face once, and then I was Beatrix Esmond, and your mother is my half-sister."

and the new viscount had none of the nobility of his father's character. Indeed, there was nothing to admire in the new family circle at old Castlewood, drinking, gambling, and gossip-mongering occupying most of their time.

This, of course, was not known to Harry, who called at the mansion in the absence of the owners, and was very coldly received by the servants. He left a note to be given to his cousin on his return, and betook himself to the village inn. The family returned soon after Harry's call, but when the Baroness Bernstein, the aunt of the viscount, arrived late at night, they had done nothing to welcome their Virginian cousin. Indignant at their ill-manners, she insisted that, unless one of her nephews repaired to the inn, late though the hour was, and invited Harry to Castlewood House, she would do so herself. Thus admonished, the viscount's younger brother, William, who, as was so common in those days, was fuddled with drink every night, set out for the inn, only to raise a quarrel with Harry, who had gone to bed, and finally to be brought back in a wheelbarrow!

Early next morning the baroness made good the ill-manners of her nephews by sending a note to Harry inviting him to "Colonel Esmond's house in England," and when he arrived she presented him, with charming courtesy, to his relatives. Harry immediately became a great favorite with her, and, later, when Gumbo had circulated exaggerated stories about the wealth of the Virginian estates now supposed to be Harry's property, the selfish, ill-bred Castlewoods also began to take some interest in him.

One day the baroness, when talking with Harry, showed him the portrait of a lovely young woman in the dress which was worn in the time of Queen Anne, and said to him: "Did your mother never tell you of another daughter her mother had in England before she married your grandfather?"

"She never spoke of one," he said.

"Nor your grandfather?"

"Never. But in picture-books for us children he used to draw a head very like that," said Harry, looking intently at the beautiful face in the portrait.

"And does the picture not remind you of anyone?" pursued the baroness, with a touch of sadness in her voice.

"No, indeed," he said.

"Harry, that was my face once, and then I was called Beatrix Esmond, and your mother is my half-sister, child, and she has never even mentioned my name!" she said very quietly.

BEATRIX GROWN OLD IS KIND TO HENRY ESMOND'S GRANDSON

The baroness was indeed the wayward Beatrix of long ago, who had caused much sorrow to her mother, and had fluttered the heart of Colonel Esmond. In her old age she had a melancholy pleasure in showing kindness to the grandson of those to whom her conduct had once given pain.

Harry's time was now passed in none too intellectual pursuits, for he soon fell into the habits of the house, playing at cards for money with his drunken cousin, Will, and Parson Sampson, the Castlewood chaplain, who resembled many of the clergy of his time in being more given to pleasure than to good work. He also found himself an object of particular interest to Lady Maria, Lord Castlewood's step-sister, who endeavored to pass for twenty-seven, though her age was forty. Prompted by Gumbo's stories of Harry's wealth, this designing woman conceived the idea of becoming Mrs. Harry Warrington, and Harry innocently was in a fair way to encourage her in her scheme. But the baroness set herself to thwart the plans of Lady Maria for Harry's sake, and took every opportunity of letting him know the truth about that person.

HARRY BECOMES A "YOUNG MAN OF FASHION" AND IS IMPRISONED FOR DEBT

On his way to Tunbridge Wells, a fashionable place of resort at that time, a riding accident was the cause of his being carried to the house of Colonel Lambert, whose wife had been at school with Harry's mother, when Rachel Esmond had been sent to England for her education.

The home-life of the Lamberts was so wholesome and unaffected, compared with the low tone of the Castlewoods, that Harry felt as if he had passed into another world, and could have lingered indefinitely with them, enjoying the society of the colonel's daughters, Theo and Hester, for the former of whom he speedily conceived a tender regard. But he was bidden to join his relatives at Tunbridge, where his easy good-nature let him be led into ways that did him no credit. Among the gay gamblers he was soon a man of note, though many stories of his conduct were exaggerated; and when he moved to London to continue the life of a young man of fashion, he soon found himself in jail for debt.

When this news reached the baroness she was ready to help, but meanwhile the artful Lady Maria had effected a little plan to win the heart of Harry by visiting him in prison, and bringing all the trinkets and jewels he had given her, in order to raise money for his release. His simple, honest heart was touched, and he now felt bound to Maria, so that when the baroness offered to pay all his debts on condition that he would give up Lady Maria, he refused, and no doubt thought himself a very gallant gentleman in consequence.

GEORGE WARRINGTON COMES TO LIFE AGAIN AT AN OPPORTUNE MOMENT

Harry was still in prison when, one day, to the amazement of the baroness, "Mr. Warrington" was ushered into her room, and for a moment she was bewildered, as her visitor was extremely like Harry. He was none other than his twin brother George, who had not been killed, as was supposed, but, after a term of captivity, had been enabled to make his escape, and had now come to England in the nick of time to save Harry from a foolish step.

George was able to effect the release of his brother, although Colonel Lambert and Colonel Wolfe, good friends of Harry's whom he had treated none too well, were taking steps in the same direction before George's timely arrival. Freed from prison, Harry still foolishly persisted in his declared intention to marry Maria, and the baroness now determined to join forces with George in the hope of turning Harry from his purpose. After she had explained the trickery and hypocrisy of Lady Maria to him, George decided to put Maria to the test. By posing as the

selfish elder brother, he gave out that Harry, having squandered his own fortune, would receive no help from him, and would be dependent on the capricious favor of his mother for the future. This speedily altered the mind of Lady Maria, who had no wish to be Mrs. Harry Warrington in the absence of a fortune, and fortunately she herself took the step of freeing Harry from his promise to marry her.

HARRY FIGHTS AT QUEBEC WHILE GEORGE REMAINS IN ENGLAND

Depressed in spirits, and perhaps just a little jealous of the interest which Mistress Theo showed in his brother George, Harry joined a naval expedition as a volunteer. Later on, when his friend Wolfe had risen to the rank of general, and was in command of the British forces despatched against the French at Quebec, Harry was invited to become one of his officers, and was present at the great engagement when the gallant Wolfe met his death in the hour of victory.

Meanwhile, George had taken up the study of law in London, uniting with this a practical interest in literary pursuits. He wrote a successful play which the great Doctor Johnson was understood to have seen with approval on its performance. In fact, George was cutting something of a figure in the literary society of the time, and showed his good sense by falling completely in love with Mistress Theo Lambert, whom, in due course, he married, with the somewhat grudging approval of his mother.

Strangely enough, Lady Maria also married for love, an actor who had performed in George Warrington's play having won her heart, and although the couple were extremely poor we are to believe they were not unhappy. Another and more important wedding, so far as our story is concerned, was that of Lord Castlewood with an American heiress, Miss Lydia Van den Busch, whose wealth did much to restore, outwardly at least, the fading grandeur of Castlewood.

GEORGE WARRINGTON NOW TELLS THE REST OF THE STORY

For the rest of our story we are supposed to read from the papers of George Warrington, whose delight in the literary art led him to put on record some of the more interesting episodes in his own career and the lives of his relatives.

In the year following the taking of Quebec, Colonel Lambert was appointed Governor-general of Jamaica, and was to proceed thither with his family. The day after we heard this news, Theo and I were privately married, lest we should be separated. My mother having written to me before news of my marriage could reach her, urging my return to Virginia, she was none too well pleased at my conduct in the matter, and showed no readiness to help me in the difficulties which I had now to face, through lack of funds, after discharging the debts incurred by Harry.

My hopes were for the time set upon a new play I was writing, but these were presently doomed to disappointment when the play was produced without success. Meanwhile, my Aunt Beatrix had died, leaving all her property, amounting to more than four thousand pounds, " to her dear nephew, Henry Esmond Warrington, of Castlewood in Virginia, in affectionate love and remembrance of the name which he bore."

GEORGE'S FORTUNES BRIGHTEN AND HE SUCCEEDS TO THE BARONETCY

This money I had forwarded to Virginia before I learned that my mother had ceased to send remittances to me; but the death of my young cousin, the son of Sir Miles Warrington, after whom my own son had been named, vastly changed my worldly prospects, and if for the time I felt the lack of means, I had the knowledge that my future was assured. Indeed, it was only in the following year that Sir Miles himself died, and I found myself Sir George Warrington, baronet, of Warrington Manor.

By this time, also, my brother Harry having seen fit to marry Fanny Mountain, the daughter of my mother's companion, the favor which my mother had been lavishing on Harry was again diverted in my direction, and after a time Madam Esmond so far softened towards my wife and myself as to invite us to visit her in Virginia. For some little while this was impossible, but when General Lambert returned from Jamaica, on the death of his wife, we left him in charge of Warrington Manor and set sail.

When we arrived at Madam Esmond's house, my mother met us at the door, and gave both of us her blessing as we

knelt before her. Conceiving a great liking for my dear wife, which was no surprise to me, my mother was presently so entirely amenable to Theo's advice and influence that she relented in her attitude towards my brother's wife, and received her in her house at Richmond.

GEORGE VISITS HIS MOTHER IN AMERICA AND SEES MORE FIGHTING

The political troubles which had long been brewing between the home Government and the American colonies were now at boiling point. For myself I remained loyal to the British Government, while Harry took the colonial side, though this in no wise weakened our brotherly relationship. When war broke out I saw some service under the British flag, but a wound received at the battle of Long Island proving slow of healing, I was led at length to return to my English home, where my elder children had been sent three years earlier.

Before leaving America, however, I had an opportunity of meeting Harry under a flag of truce, in the camp of General Clinton, with whom he was then serving, and the truest of friends and fondest of brothers came with me to the place of parting.

Before the war ended Harry had risen to the rank of general, and afterwards he visited us at Warrington Manor, soon after the death of his wife, whose good qualities he never ceased to praise. It was the fond wish of Theo and myself that he might some day marry Hester, and he did indeed venture at length to propose to her, but she declined to marry so long as her father lived.

I had but little intercourse with Lord Castlewood after I became the master of Warrington Manor, but that nobleman, thanks to the suggestion of his American father-in-law, laid claim to our Virginian estates on the ground that only a life interest in these had been granted by his father to Colonel Esmond, and that it was not intended they should have passed permanently from the possession of the Castlewoods. His brother William, who had been shot as a spy in America, had been there, I suspect, for the purpose of destroying the proofs of our absolute ownership to the Virginian estates.

At any rate, my mother discovered that the documents had been burned, but fortunately Parson Sampson, whom I met by happy chance, knew of a copy of the assignment which existed at Castlewood, and boldly going thither we got possession of this, and successfully confronted Lord Castlewood with proof of his dishonesty.

That nobleman had coolly offered to let us retain possession of the estates on payment of a greater sum than they were worth, thus showing his baseness. From that day I never again set foot in the historic home of my ancestors.

SIR GEORGE'S TRANQUIL LIFE AT WARRINGTON MANOR

At her house in Richmond, Madam Esmond still lives. Shall I ever see the old mother again? When Hal was in England we sent her pictures of both her sons, painted by the admirable Sir Joshua Reynolds.

We have copies of both of these paintings at Warrington Manor, but the picture which my son, Captain Miles, and the girls declare to be most like is a family sketch by my ingenious neighbor, Mr. Bunbury, who has drawn me and my lady with Gumbo following us, and written under the piece, "Sir George, My Lady, and their Master."


"Sir George, My Lady, and their Master."

Here my master comes; he has poked out all the house-fires, has looked to all the bolts, has ordered the whole male and female crew to their chambers, and begins to blow my candles out, and says, "Time, Sir George, to go to bed! Twelve o'clock!"

"Bless me! So indeed it is." And I close my book, and go to my rest, with a blessing on those now around me asleep.

THE NEXT STORIES OF FAMOUS BOOKS ARE ON 3515.

The wonderful effect that motion has upon matter is well illustrated in this picture. A candle, if pressed against a wooden board, would be pressed out of shape. But fired from a gun, so that it travels at a great speed, the candle will go right through the wood without itself being injured.

HOW MOVEMENT CHANGES MATTER

THE WONDERFUL FORCE OF MOVING THINGS

CONTINUED FROM 3354

WE must now go on to another part of the Story of the Earth. We have already a good idea of what the earth is, and we have studied some of the other worlds in space, in order to learn more about the world we live on. We have learned also about the different kinds of elements that make up the earth and the sun and the stars, and the way in which those elements combine with each other. If we are to use big words, then we can say that we have studied geology, and astronomy, and chemistry, and geography—not the geography that deals with frontiers and cities, but natural, or, as it is called, physical geography; and, lastly, we have studied agriculture.

There still remains to us a very important and very big study, the special name of which is physics, a name derived from the Greek word for Nature. By physics we now mean the study of motion, heat, light, sound, and electricity. Of course, there is no real division between physics and some other sciences, like chemistry, and we cannot understand the one without the other. Nature is not made in water-tight compartments, though I am afraid we often talk and think as if she were, and as if our minds were. It is only for convenience, and because we cannot see everything at once, that we have to study one thing at a time. So here we shall go on to study motion, which is very much more interesting than perhaps it sounds.

When we look at the world around us or at our own bodies, we find that there are two things to catch our eye, matter and motion. In many parts of this book we read about matter—what it is made of, and the way it is put together to form rocks, and planets, and stars. We cannot say anything more about matter itself here, except simply that we do not know much about it. Some years ago, men thought they really did know all about matter. Now we know that all we have learned—and we have learned a great deal—is only just the beginning. But, at any rate, we know what we are talking of when we use the word "matter," and we can go on to study the thing that is called motion.

Now, motion is not a "thing" in the sense that matter is, and yet it is real. If a boy observes the difference between holding a baseball in his hand and stopping that baseball when it is hit hard in his direction, he will know that motion is real. Or if we notice the difference between our feeling when we jump off a single step into the water and when we dive from a great height, we shall know that motion is real. We are beginning to believe that it is more real than

matter, and that matter is really a state of motion of something that we call the ether.

This is so important, and new, and interesting that we must try to understand it. We believe that everywhere throughout the world there is something called the ether. People have laughed at it, and said it was just imagined, but it is probably the most real of all real things except mind. If mind, by means of which we learn about other things, is not real, then nothing is.

HOW MOVEMENT HELPS TO MAKE LIGHT AND HEAT AND TO MAKE MATTER REAL

Now, when the ether is doing nothing, we are not aware of it ; nothing happens, it might not be there. But when the ether begins to move—and it may move in many different ways—then many things begin to happen. That is one good reason for saying that motion is very real. If the ether moves in a particular way, as we shall learn afterwards, there is produced the thing we call light.

Light and radiant heat, the kinds of invisible light about which we shall learn, including the X-rays, and also electricity and magnetism—all these are states of movement in the ether. Now, if we have the least idea of what these things count for in the world it is quite evident that motion is a very real and important thing. But that is only just the very beginning of what there is to say about it. We are learning that not only the air, but hard matter, such as rock or steel, is also a state of motion in the ether—a different kind of motion from that which produces light and heat, but a state of motion nevertheless.

Heat, we know, means two things, the radiant heat which comes from the sun or a fire, and is a movement of the ether, and the heat of a hot object when we touch it. This last heat, we believe, is due to a to-and-fro movement—a vibration, as it is called—of the atoms and molecules in the hot thing. So this kind of heat also is due to motion.

A CHAIN THAT SPINS AND BECOMES LIKE A HOOP OF SOLID STEEL

But now let us think a little further of what this means. As a rule, when a thing is made hot it gets bigger. This means that part of the size of the thing is due to its heat—that is to say, to motion. May it not be that the atoms and molecules themselves owe their existence to motion ? There are many experiments—and these are being increased every day—that make it probable that this is true. One of the most remarkable of these may be mentioned, and if we have a chance of seeing it done anywhere, we should certainly do so. Can we believe that the hardness, the stiffness, the firmness of a thing can be made simply by the fact that it is moving ? If we could suppose this, then we could suppose that the movement of the ether could make it into matter—which we, of course, think of as something hard. Now, if we take a ring of chain, which, of course, simply lies in a heap huddled on the floor, and if we get hold of it in such a way that we can make it spin round at a tremendous rate, it becomes quite stiff, as if it were made of one piece of solid steel, and it will run for a long distance like a stiff hoop until the spinning, or rotation, of it has been exhausted, and then, of course, it will collapse into a little heap of links as at first. The rotation made a thing with no stiffness into a stiff thing.

HOW A CANDLE CAN BE FIRED THROUGH A WOODEN DOOR

Another wonderful illustration of this is the firing of a candle through a wooden door, the motion imparted to the candle enabling it to make a hole through the wood without itself being injured.

Again, we may take a piece of quite soft tissue-paper, stretch it out and spin it at a great speed. It will cut anything we please, just like a knife. Yet it is only a piece of soft tissue-paper. We have made it hard by making it move. It is possible to show experiments like this, one after another, for an hour on end, every one of them showing that the properties of which we think when we think of a piece of rock or stone, can be created in things that have no such properties, by making those things move in certain ways.

But by far the most wonderful experiments are those we make with rings of smoke. A smoker can blow from his lips rings of smoke, or we can inject smoke into a square box with a hole in it and an elastic back, and then by hitting the back we can knock rings of smoke out through the hole. These rings are just the same as the smoker makes, but much larger and more easy to observe. Before we can notice what these rings

do, or can understand at all what we see, we must learn two things. The first is that the smoke—that is to say, the little specks of stuff that make the ring visible—has nothing to do with the question. We cannot do without the specks, just because they make the ring visible. The real ring, however, is not a smoke ring, but an air ring. Equally good rings are made by hitting the box when we have burned nothing in it ; and we can blow as perfect rings from our mouths when we do not smoke as when we do. Very few people understand this. They think that the smoke is necessary, but the smoke merely shows us the ring.

The second thing to remember is that the ring of air, or gas, has another and distinct motion. It moves through the air, we know, for we can see that. But the point is that the portions of gas that make it up are themselves in movement, and this second movement is something like that which we get if we take an india-rubber ring, and run it along a rod which it fits tightly. The ring keeps on turning itself inside out. Well, a smoke ring, as we call it, moves in this way, and the special name given to it on that account is " vortex ring." The word, like many other English words with v, r, and t in them, means turning and twisting.

THE MARVEL OF A RING OF SMOKE THAT CANNOT BE DESTROYED

So a smoke ring is really a portion of the air which, unlike the air around it, is in a peculiar state of motion, and we find that this peculiar state of motion gives it the most extraordinary properties. For one thing, it lasts a long time, and retains its independence of the air around it, and it resists attempts to destroy it. We cannot cut it with a knife. If we try to do so, the ring dodges us. One ring may be blown through another, but we cannot make one ring smash another. Now, all this, and much more, entirely depend upon the way in which the air that makes the rings is moving. This motion confers upon the rings the power of resistance. It makes them, like the atoms of matter, very difficult to destroy. It gives them a sort of hardness, just as the spinning of the steel chain gives it hardness. Lord Kelvin, the greatest man who has studied these questions since Newton, supposed that matter may be made up of things like vortex rings. It may be that the ether, by being put into a special state of motion, becomes matter, just as by setting the air into a special state of motion we can turn parts of it into special separate things, like smoke rings.

THE WONDERFUL RING THAT MAY EXPLAIN THE MYSTERY OF THE UNIVERSE

This vortex-ring theory of matter is the most famous theory of the kind that has ever been suggested, and in all probability it expresses a great part, though doubtless not the whole, of the truth. We shall agree that it justifies what was said at first, that perhaps motion is more important than matter. That must be so if motion makes matter. All over the world, men are now studying the nature of matter from this point of view. The electrical theory of matter which they are now studying is really a sort of version of what we have been saying, and every year we shall hear more about this subject.

Meanwhile, we must learn some other things which teach us how important motion is. When we stop a moving baseball, we know that there is power in it, and that it requires power to stop it. Now, the baseball is the same after it was stopped as it was before, but that power is no longer in it. Its motion was its power. When a train, or a motor-car, or a flying-machine moves, we know the power is coming from somewhere. In every one of these cases, the power is produced by the pressure of a gas, that is somehow or other made in the engine of the machine.

A gas is made in such a way that it wants to expand or stretch itself, and as it does so it drives the engine. This pressure of gases is one of the most important things in the world. Where does it come from ? Many men, working together, and after each other, have proved during the last century the truth of a beautiful theory that is called the kinetic theory of gases.

THE MILLIONS OF MOVING ATOMS OF GAS THAT DRIVE THE MOTOR-CAR

Everyone knows that a kinematograph is a moving picture, though we often spell it with a c, and pronounce it as if it were an s, which only confuses us. The word comes from the Greek word for motion, and so the kinetic theory of gases simply means the theory

that the pressure and the other properties of gases are due to the movement of the little atoms and molecules that make up the gas. This is now proved to be true. It is the little motions of unthinkable millions of molecules that make the big motion which we see of the train or the motor-car. It is the adding together of these tiny little motions that makes great masses of rock fly into the air when we cause an explosion, or that sinks a battleship when a torpedo, or submarine mine, explodes. Never was there such a good illustration of the proverb that "mony a mickle maks a muckle." Motion is power, and the big motions that we see, and all their power, are due to the little motions we cannot see. There is another most extraordinary thing of which very few people have thought, but which should make us interested in motion if nothing else does.

THE ONE AND ONLY THING THAT HUMAN BEINGS CAN EVER DO

Here are we human beings, who could not live for a minute without the motion of the blood in our bodies; and we are become the lords of the earth; we have changed its surface so much that men upon the moon could see the difference we have made. We rule other living creatures; have built great cities and ships; have learned many of the secrets of the stars. And yet when we look upon ourselves and ask what it is that we can do, what it is by means of which mankind has done and will do everything, the answer is simply that we can move things. That seems absurd at first, but it is absolutely true. There is nothing that any human being has ever done, or ever can do, that does not depend upon his power to move things. All he can really do is to move his own body, in part or as a whole, and so, by pushing against other things outside him, he can scoop a hole in the earth and live in it, or put together machines that will build a palace.

We move our chest, and lips, and tongues, and so we speak, or we move our bodies to get hold of something that will make a mark; we move our fingers round that something, and then move it on something else, and so we write. We have done wonders, and we shall do much greater wonders yet; but all we can do is to *move things*. The lesson to be learned from this is how great the result of the mere movement of things may be. Indeed, just as all the doings of Nature depend upon movement, so do all the doings of man.

HOW WE ARE ABLE TO KNOW WHEN THINGS ARE MOVING

We have only to think of the apparent motion of the sky as the earth turns, or of the way in which we may be puzzled to know whether our train, or the train on the other line, is moving, to understand that we only know the movement of a thing by comparing it with something else. The only motion we can understand is relative motion. If there were just one point in the universe that could think, and there were nothing else in all space, that point could, of course, move about. But no one can imagine any means by which it could know that it was moving at all, much less the rate or direction of its motion. All we know, then, is motion as compared with something that is not moving, or that is not moving in the same way. Thus the whole universe of stars may be moving, but whether it is doing so, and, if so, in what direction and at what speed, no one can say, because there is nothing against which to test this motion. If the ground runs along under a runner as fast as he runs, how shall we measure his running? And this applies alike to trains, and stars, and everything else.

A solitary thinking *point* and not a thinking *person* has been suggested, and the reason for that was that there are two kinds of motion which a person might undergo, just as there are two kinds of motion which we see in a smoke ring. The smoke ring can move as a whole, and its parts can twist and turn among themselves.

HOW OUR BODIES ARE WHIRLED ALONG WHILE WE SIT QUIETLY IN A CHAIR

So we also can move about from place to place, or we can double ourselves up without moving away from where we were. If one of us were utterly alone in space, he could learn what motion was by moving his body about, but he would know no more of the motion of his body, as a whole, than we do when we sit quietly in a chair, not knowing that in every second of time our bodies are moving many miles with the earth. Motion from place to place is often called *loco*-motion, which just means

place-motion; and we call a machine for producing such motion a *loco*-motive. But the proper name for this kind of motion is *translation*, and we compare that with *rotation*. Translation literally means carrying across; rotation, we know, means spinning, and a thing may be undergoing either of these kinds of motion, or both. When a baseball is batted, the batter usually so arranges that it has both a movement of translation, which we can all see, and a movement of rotation, of which we see the results when a ball touches the ground or swerves in the air. As the earth flies through space it has both movements, the translation making the seasons, and the rotation making day and night. When translation of any body occurs, rotation is quite difficult to avoid. Drop a book or a ball from a window, and we find it very difficult to prevent it from twisting as it falls.

THE SLOW SHIVER OF THE EARTH UPON ITS AXIS

Along with these two kinds of movement, there is a third, which is a movement of vibration, or trembling. This to-and-fro movement, which we can feel in ourselves when we shiver, is not the same as rotation. It is really a movement of translation, but as it is constantly reversed, the moving thing does not change its place altogether. A wave is an instance of a movement of vibration, and we must clearly understand what many people find difficult, that the point is not the rate of the vibration. The to-and-fro movement may be millions of times a second, or it may be only once a second, or even slower still. The to-and-fro swing of the pendulum is a true vibration, and would be a true vibration if it were a million times quicker or a million times slower. The axis of the earth seems to undergo a great vibration, or to-and-fro movement, which is quite distinct from its movement of translation and its movement of rotation, and the period of this vibration—to use the proper term—is not one second, as it may be with a pendulum, nor yet less than a billionth of a second, as it may be with a wave of light, but about twenty-five thousand years. Yet it is a vibration. These three words, translation, rotation, and vibration, we should always remember when we think about motion. When we study the universe as a whole, and find things in motion about us, the first question we are bound to ask is: Where does this power come from? The only answer to this question is that it comes from the great Cause and Author of all things. He is the first and ultimate cause of all motion.

THE GREAT LAW THAT MOTION AND POWER ARE NEVER LOST

If now we ask what are the nearer causes, we make one great discovery, which is the greatest discovery ever made by science, and which is often referred to in this book, and in every other book that deals with science at all. This discovery is that motion, like power in all its other forms, is never made out of nothing, and never lost. This was guessed by the first of the Greek thinkers, Thales, some 2,500 years ago, and it was proved once for all in the nineteenth century.

Wherever we find motion, there we know there must have been either some other motion, of which this that we see is the continuance, or else some power has been spent somewhere to produce it. When a ball leaves the arm, the motion of the ball and the power of it have been derived from the power in the sugar of our muscles when the ball was thrown. And so in every case. This great principle, which is true not only of motion, but of everything else, has a special name, which is rather long, but is not really difficult. It is called the *conservation of energy*. Energy is just a special word for power, and the law of conservation states that power is never lost; it is also part of the law, though the name does not say so, that power is never made out of nothing.

One of the ways in which this shows itself is in what is known as Newton's first law of motion. Everyone should know this, for it applies to everything. It is often called the law of inertia, which simply means "doing nothing."

WHY MOVING THINGS DO NOT GO ON MOVING FOR EVER

This law says that when a thing is moving, it does nothing itself to change its motion. It therefore will go on moving for ever, and in exactly the same direction, and at exactly the same speed, unless and until some other power stops it, or turns it, or makes it go slower or faster. That is half of the law of inertia, but only half of it; and it is given first

because it is the half that people usually forget when they talk about inertia. The half that most people know is really the same thing, but looks different. It is that when anything is at rest, it remains at rest, doing nothing, until something moves it. Whenever we think of inertia, or Newton's first law of motion, we should remember both halves of it, or, rather, the two ways in which it works out.

WHY A BALL FALLS WHEN IT IS THROWN INTO THE AIR

Everyone understands how it applies to a thing that is not moving, but very few people remember how it applies in the other direction. They do not know that a thing which is moving will not stop unless something stops it. We see a ball thrown up into the air, or thrown over the surface of the earth, and we know that the motion ceases. This is our experience with practically all motions, and so we get the idea that when a thing moves it gets tired, after a time, and stops. It was one of the most tremendous discoveries ever made that this is not so, and that the smallest touch applied to the biggest thing, sufficient to move it at all, will keep it moving at that speed and in that direction for ever, without its ever getting tired. When the ball thrown up is stopped, the earth by its pull stops it, and the resistance of the air helps also in the stopping of the ball.

When a ball running along the ground stops, it does so, not because it has a tendency to stop, but because the resistance of the air and the friction of the ground stop it. The real tendency is for the thing that is at rest to remain at rest, and for the thing that is moving to go on moving. If we think of the matter, we shall see that if things did not behave in this way, the law of the conservation of energy would not be true.

THE GREAT LAW OF NEWTON THAT EXPLAINS WHY THINGS STAND STILL

If things could be started moving without anything moving them, then power, or motion, would be made out of nothing; if moving things could be stopped without something stopping them, then motion, as we can easily see, would be made into nothing. That is what we mean when we say that Newton's law is really a special illustration of the great law of conservation.

Newton discovered two more laws of motion, thus making three, which will always be known by his name. The second law is quite simple. It says that when anything is made to move, its motion is in strict proportion with the force that makes it. Further, the thing moves in the direction of the straight line in which the force acts. This is true, no matter if there be twenty different forces acting in different directions upon a body, and it is true whether that body be at rest or already in motion.

Using this law, it is possible for us to find out exactly in what direction. and at what rate, a body will move if we know the power and the direction of any number of forces that may be acting upon it. We discover also the profound truth that rest is a state of balance of forces; forces are pulling, but other forces are pushing. These exactly oppose each other, and so the result is rest. Gravitation is pulling this book as it lies on the table, but the strength of the table resists the force of gravitation, and as it acts in exactly the opposite direction to that force, the book remains at rest.

HOW A GUN HELPS US TO UNDERSTAND THE LAWS OF MOTION

Newton's third law of motion is that "action and reaction are equal and opposite." This great law, which is really, when we come to examine it carefully, another version of the law of the conservation of energy, is very well illustrated in the kick, or recoil, of a gun when it is fired. The amount and force of the rifle as it kicks back are exactly equal and exactly opposite to the amount and force of the bullet as it goes forward.

We shall next have to name briefly three other laws of motion which we know by the name of Kepler's laws. We must not confuse them with Newton's laws, but they are in some ways just as important, because they lead up, as we shall see, to Newton's greatest discovery, the law of gravitation.

All these laws are of supreme importance, and though we may not be able to understand all their details, we should certainly know something about them, for the existence of the universe, including this world on which we live, depends upon them.

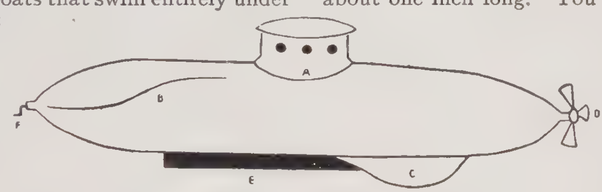
THE NEXT PART OF THIS IS ON PAGE 3587.

HOW TO MAKE A TOY SUBMARINE

CONTINUED FROM 3328

MOST boys have either seen a real torpedo boat, or have seen a picture of one dashing over the sea. They are wonderful little ships that travel almost as fast as an ordinary railway train—twice as fast as the great men-of-war that they are intended to destroy. They dash out at a speed of nearly forty miles an hour towards the great ships, and, when they are quite close, they fire one of the deadly torpedoes they carry, and the torpedo swims under water like a fish, until it strikes the big battleship. Then it explodes and blows a huge hole in the side of the ship. One torpedo would sink the biggest ship ever built if it struck the hull under the water line.

But there are even more wonderful boats than these. They are the "submarines"—the little torpedo boats that swim entirely under water so that no ship can see them coming. They can dive deep down out of sight and fire their torpedoes while they are almost underneath the great battleships.



1. The submarine boat complete. The letters mark: *a*, Conning tower; *b*, curved fin; *c*, keel fin; *d*, propeller; *e*, lead keel; *f*, handle.

Perhaps it has never occurred to you that you might make a model submarine that would swim under water just like the real ones. Yet you will not find it difficult if you read this description first, and carefully follow the directions, and when you have completed it you will find it one of the most fascinating things you have ever had.

You can make it swim in a bath or a small pond. It will dive under water and travel twenty or thirty yards before it comes up again. With your submarine torpedo boat you can play at a naval battle with your friends who have ordinary wooden boats that float. The floating boats will represent the men-of-war, and you will try to make your submarine swim under the water and hit them. If it touches a boat you must consider that boat destroyed, for that is what would happen in real war if a submarine got close enough. Now let us see how to make it.

First, you must get a piece of wood about eight inches long and two and a half inches thick. A piece of curtain pole will do splendidly, if you can find one that is made of soft wood. With a sharp knife you must cut the two ends to rather sharp points. When this is done your piece of wood will look like a big cigar. The ends should be rubbed with sand-paper till perfectly even.

Now you must drill a hole from one end of the wood to the other. This can be done with a long gimlet. You can bore from each end till there is a hole right through.

Next you must buy a pea-shooter from a toy-shop—it will cost a few cents—and with a file you must cut off two pieces about one inch long. You must make the hole rather bigger at each end of the wood and let in the pieces of pea-shooter. Each piece should project a little, as you can see in the illustration number 5.

The next thing you have to do is to make the propeller, or "screw," that will drive the submarine. This will be quite easy. You have only to knock the bottom out of a small tin can, and cut it to the shape shown in picture 2. The fan-shaped pieces must be twisted slightly like the propeller of a real ship.

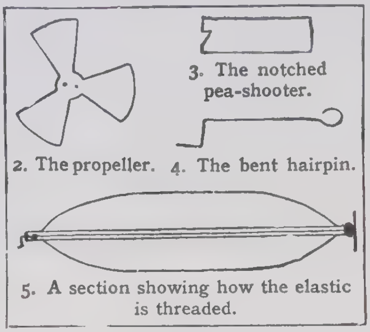
Now drill two small holes in the centre, close together, and pass a piece of elastic through them—the sort of elastic that is used for catapults. Get a big glass bead, rather larger than the diameter of the pea-shooter, and thread the elastic through this, then pass the elastic right through the hole in the centre of the wood

Now, at the other end, file two little notches in the pea-shooter as shown in picture 3. Then make a little handle out of a hairpin, bent as in picture 4, draw the

elastic rather tight, hook it on to the handle as in 5, and then the mechanical part is done.

If you hold the propeller still and turn the handle at the other end, the elastic will be twisted up tightly. Then, when you release the propeller, it will buzz round quickly and, of course, when you put your ship in the water, it will drive it along.

But at present your boat will float. To overcome this you must get a piece of lead tubing. This should be beaten out flat and nailed along the wood to form a keel. It is of the right weight if, when you put your boat in the water, only just the top shows above the surface.



2. The propeller. 3. The notched pea-shooter. 4. The bent hairpin. 5. A section showing how the elastic is threaded.

To make it dive you must nail "fins" to it. These fins are easily cut out of tin, and they must be put on with a slight tilt, as shown in picture 1. A straight "fin" at the bottom will make it complete. Now wind the elastic tightly, holding the propeller with the left hand. Then put the submarine boat in the water, still holding the propeller. Hold the boat steadily about a foot beneath the surface and then let the propeller go. At first your submarine will try to rise, but as it begins to travel faster the fins will keep it below the surface, and it will dart along through the water just like a fish.

If you want it to look particularly smart you can make a "conning tower" out of a piece of wood and fix it to the top.

When you have tried it and made sure that it travels well, give it a coat of grey paint, and then it will look just like one of the real submarine boats of which you have heard so much.

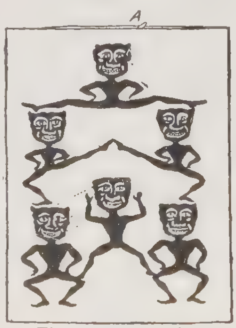
If you use it in a pond you need never fear you will lose it, because it will stay under water only so long as the propeller is revolving. When the propeller stops the boat floats to the top of the pond.

THE IMP WITH A DISAPPEARING HEAD

THE apparatus for this trick consists of a card measuring about four inches by three inches, representing six little imps, as shown in picture 1.

You explain to the company that this card, which you carelessly show back and front, represents the celebrated troupe of Hikickalorum acrobats giving their marvelous performance. "You will notice their little feet," you may observe. "I will now show you their great feat, which you will find even more worthy of admiration. The two gentlemen in the middle row will kick off the head of the single gentleman just below them. If you have good sight, and watch them carefully, you will see their legs move."

Holding the card between the second finger and the thumb, the picture side facing the company, you give it a quick wave from right to left and back again. The spectators will *not* see the legs move, though some of them will probably persuade themselves they did so; but, anyhow, there is "no deception" as to the main effect promised. The head of the figure indicated has miraculously vanished, and the picture appears now as shown in 2.



1. First position of card.

2. Second position of card.

Of course, it would not do to leave the unfortunate imp in this headless condition. You explain that his head has been kicked up into the air, where it is still floating somewhere. "I will endeavor to catch it for him," you say, "or, rather, I will let the owner catch it for himself." Holding the card as before, you give it this time a quick up-and-down movement. If you are clever, the spectators have never lost sight of the figures, but somehow the head is back again as at first.

The picture, though it is to all appearance a simple piece of card, is in reality a very ingenious piece of mechanism. The supposed card is, in fact, two cards, joined together round the edges. Between them works a little lever of sheet brass, with its outer end projecting at the top of the picture, as shown at A. The "head" is movable, working on three bits of fine white horsehair, as indicated by the dotted lines. These are, by artificial light, imperceptible at a few feet distance. When A is as shown in picture 1, the head is in its normal position, but if A be pushed over as shown in picture 2, it is drawn over that of the imp in the lower left-hand corner, which it exactly covers, and so has apparently disappeared off the card.

The working of the trick will now scarcely need explanation. Under cover of the sideways movement the performer shifts the lever to the position shown in picture 2, and the head is gone. Under cover of the vertical movement he shifts it back again, and the head returns.

The cost of the card, from almost any conjuring shop, is not very great.

CURIOUS THINGS ABOUT THE ALPHABET

WHEN first we went to school and learned our A B C we did not think it at all interesting. But there are many things about the alphabet which are very curious and very interesting indeed. For instance, if we were given a set of A B C blocks, and were asked in how many different ways we could arrange them, we might, perhaps, say that we could place them in two or three hundred different ways. But if we said thousands, or even millions, we should be hopelessly under-estimating the possible number of changes.

A great authority on the alphabet, Professor Max Müller, has pointed out that if we take only 24 letters, which is the number contained in the alphabets of many nations, these letters can be arranged in 620,448,401,733,239,439,360,000 different ways. It is, of course, quite impossible for us to grasp what these enormous figures mean, but let us put it in another way. Suppose we wanted to have all these different arrangements of the alphabet written out, and we set all the people of all the world to work, writing at the rate of forty pages a day, with forty sets of letters on each page, they could not complete the work in a thousand million years!

AN ALPHABET WITH 214 LETTERS

The letters of the alphabet appear practically in the same order in nearly all languages, but how they came to be in this order nobody knows. The number of letters in the alphabets of different languages varies considerably. English and German have 26 letters; French, 25; Spanish, 27; Italian, 20; Russian, 36; Greek, 24; Latin and Hebrew, 22; Celtic, 17; Arabic, 28; Persian, 31; Turkish, 28; Sanskrit, 44; and Chinese most of all, 214.

Of course, in all languages the alphabet is imperfect, and various letters have to stand for more than one sound each. In our own English language, for instance, it is estimated that there are 42 sounds, and only 26 letters to represent them. Even then some of the letters, or signs, are only repetitions of others, as C, which could always be represented by either K or S. Ch, on the other hand, has no letter to represent its sound, which has nothing to do with C or H.

Referring to the myriad ways in which the letters of the alphabet may be transposed, all the words of all the languages, of course, consist of arrangements and rearrangements of a greater or smaller number of these few letters. Martin Luther tells us a story of a lazy monk who, instead of saying his prayers, used to repeat the alphabet and then ask that Providence would put the letters together to form suitable words.

THE ALPHABET IN ONE VERSE

There is one verse in the Bible that contains all the letters of the alphabet except J, which was originally the same letter as I. It is found in Ezra vii. 21, and the little used letters X and Z are found in the names Artaxerxes and Ezra. Two English words contain all the vowels in the alphabet in their right order—facetious and abstemious. At least eighteen other words contain all the vowels, although in these they are not in their proper order: Authoritative, disadvantageous, encouraging, efficacious, instantaneous, importunate, mendacious, nefarious, objectionable, precarious, pertinacious, sacrilegious, simultaneous, tenacious, unintentional, unequivocal, undiscoverable, vexatious.

There is very much that is interesting about the separate letters of the alphabet. E has been described as

The beginning of eternity,
The end of time and space,
The beginning of every end,
And the end of every place.

A BADLY TREATED LETTER

The letter H has always been a difficulty with English people without the advantages of education, and the Cockney habit of leaving it out when pronouncing words in which H should be sounded, and putting it in where it does not exist, has given rise to the following amusing protest of the letter H:

Whereas by you I have been driven
From 'ouse, from 'ome, from 'ope, from 'eaven,
And placed by your most learned society
In Hexile, Hanguish, and Hanxiety;
Nay, charged without one just pretence
With Harrogance and Himpudence;
I here demand full restitution,
And beg you'll mend your Hellocution.

The story is told of a little maid-of-all-work, that when asked by her mistress whether her name was Anna or Hannah, she replied, "Anna, ma'am. Haitch, Ha, Hen, Hen, Ha, Haitch, 'Anna."

It is often asked why the letters M and N are used in the English Prayer-book in answer to the question "What is your name?" and in the marriage formula for publishing the banns. Some think the M stands for *Marius*, the Latin word for husband, and N for *Nupta*, bride; but this cannot be, as in the older Prayer-books N only is used and the M does not appear at all. It is probable that the N was originally adopted as meaning *Nomen*, the Latin word for name.

"MIND YOUR P'S AND Q'S"

"Mind your p's and q's" is a very common expression, and has been said to refer to the old habit of chalking up the pints and quarts of refreshment which a man consumed at an inn, and paid for at the end of the week. But it is far more likely to be an expression that originated in printing offices, where, when letters are reversed as they are in type, the small p's and q's are very liable to be mistaken for one another.

It has often been remarked that acrobats and circus-riders in taking professional names are very fond of adopting names that begin with Z. And yet the letter Z is very rarely found as the initial of a real surname. It is said that never within living memory has a member of the British House of Commons had a name beginning with Z. On the other hand, the Parliament of Victoria, Australia, has never been without such a name, Zincke, Zox, and Zeal being one or two examples.

DOLLS OF MANY NATIONS

PLAYMATES OF OTHER LANDS AND HOW TO DRESS THEM

WE all know that our little friends in other lands do not dress as we do, and the colored picture shows us the kind of clothes they wear. We should be able to tell whether a country were warm or cold if we saw the children dressed, because those who lived in the cold place would be well wrapped up in thick woolen cloth, while the children in the warm climate would wear thin muslin or cotton stuff, and very likely have bare feet.

In hot countries the sun is so strong that it scorches the skin, so we should find the children had very brown complexions—quite a deep, rich color compared with those who live in colder climates. Generally speaking, in a hot country the hair of the people will be dark, while in a cooler atmosphere the people will be fair. For instance, in India they have black hair; while in Sweden and Norway most of them are fair, and have yellow hair.

There are differences in manners and customs as well as in faces and hair. In some countries the people are far more industrious than in others—generally in the colder ones.

Don't you know how you feel more inclined to work hard on a sharp frosty morning than on a hot August day? Well, the cold and hot climates have exactly the same effect on the people who live there.

We are going to suppose that we have twelve dolls, and that we want to dress each one to represent one of our little friends in other lands. First, we shall find out exactly how to dress a doll like a little French child.

HENRIETTE—THE LITTLE FRENCH DOLL

FRENCH women are noted for their good taste in clothes, and the French girl always looks very neat, even if she is quite poor.

The rich people like to dress their children elaborately; their little frocks are most beautifully made, and often cost a very great deal of money. So we must dress the French doll very daintily, using fine blue glacé silk for the dress, with plenty of lace on the underthings—very full petticoats, with frills and frills of lace, and lots of tucks, and everything to make it look "fussy," and very full all round the skirt. Notice the long bodice and very short skirt shown in the picture, also the sash of plaid silk, with fringed ends.

French children are very often dressed entirely in plaid, and always show their knees until they are quite tall.

Observe the white socks, patent-toed kid boots (either black or putty color) buttoning up nearly to the top of the socks, and the smart little parasol. The hat is very full, and made of lace, with a blue bow to trim it.

The doll's name is Henriette, and she would wear tiny pearl beads round her neck, or perhaps a string of little pale pink corals. She would have a gold bangle, or perhaps two, on her arms, and a bow on her hair, of either black or pale blue silk ribbon.

We must choose a wax doll with a pale complexion and dark dair. In France it is the custom to allow the children to stay up late at night, often till the parents go to bed, so that we shall hardly ever find a child who has pretty rosy cheeks.

GRETCHEN—THE LITTLE GERMAN DOLL

NOW we will take a peep into Germany to try to find out what the little peasant children who live there are wearing. We shall

have to go right out into the country to find a costume that differs from our own, for if we sought out the little girls and boys of Berlin and the other big German towns we should find them dressed very much like other children. Nevertheless, the peasant class differs very much, because it has a definite costume, which it wears both on work and fête days.

The most striking feature is the "Grannie" bonnet, with its straight front, quite stiff and plain, and full-pouched back. Look at Gretchen's picture, and you will see it. It would all be made of cotton stuff, but of two colors; the back part is white, and the stiff part which goes round the head pale blue, edged with a tiny frill of white.

When we dress our doll we must part her hair and plait it into two pigtails, fastened at the ends with small bows of red ribbon. Therefore, in choosing our doll, we must see that she has long, fair hair almost yellow in color. She should have a plump little figure and a good, healthy color.

The soft white lawn blouse is cut rather low in the neck. It is full, and pouches just a little over the top of the corselet belt which Gretchen wears. This is made of black velvet, and is a straight band in shape, supported by two bands going right over the shoulder. It is laced up behind.

The skirt is of cloth or cotton, and dark blue is a favorite color. Make it full, and gather it into a plain band. It is put on after the blouse; and the corselet, which is a sort of waistbelt, fits neatly over the skirt-band.

The apron has no bib, but quite makes up for that by having *two* pockets—one on each side. It is made of white muslin, decorated with a frill at the bottom hem. Notice that this frill goes a little tiny way only up the sides of the apron.

The stockings are white, and the shoes either brown or black, with low heels, and of a wide, comfortable shape. The sleeves are small, finished by a small plain band which comes *just* to the elbow.

The doll's name is Gretchen, and if we liked we might let her hold a wooden hay-rake to show that she has been at work in the fields.

SOME LITTLE DOLLS OF OTHER NATIONS

These are some of the interesting little nursery playmates of twelve other lands. The countries that these dolls come from are :

Henriette . .	France	Ivan	Russia	Panna . . .	Hungary	Lotus Blossom .	Japan
Gretchen . .	Germany	Greta . . .	Sweden	Filomena . .	Italy	Sarah . . .	Armenia
Pieter & Wilhelmina	Holland	Dolores	Spain	Chandi . . .	India	Ahweah . . .	Eskimo

We learn how to dress these pretty dolls in their own picturesque national costumes in the articles beginning on page 3434 of this book.

GRETA—THE LITTLE SWEDISH DOLL

THIS time we are going to see how a little Swedish doll should be dressed. First of all, we must know that the climate of Sweden is much colder than ours. Though they do have warm weather in the summer-time, just as we do, it is generally much more snowy and icy in the winter. So that explains why they wear such thick stuffs and warm clothes. The girls and women are very industrious, and fond of fine needlework. They make most delightful embroideries for their houses, and decorate their own and their children's clothes with charming needlework in wools and silks. They make delicate little patterns on the children's caps and bonnets, and think nothing of embroidering a small coat *all over*—sleeves and back and front as well. Their table-linen and household things are always beautifully worked. When they go out to tea it is the custom to take some needlework with them, and they all do so. Some of us would be put to shame if we saw the large amount of beautiful needlework the Swedish children do.

When a girl is going to be married, sometimes her friends will arrange together to work a quilt for her. They collect small squares of plush or other rich material; each one takes a piece home, on which she embroiders very beautifully her own Christian name. Afterwards all the squares are sewn together, and the bride has a loving souvenir from all her girl friends.

Of course, there are different variations of this costume, peculiar to different parts of the country of Sweden. This has been chosen as being one of the prettiest.

This doll's name is Greta—pronounced just as it is spelt.

As the picture will show us, she wears a white shirt made of fine muslin gathered into a straight neckband; scarlet vest, buttoned together in front with gold buttons, made of red and black striped silk. A piece of red silk, with black lines made on it either with embroidery or braid, would give the right effect, if we are unable to get the right kind of silk. The kind known as English silk can often be bought striped alternately red and black, and it is quite cheap.

The pocket.

The jacket is made of dark bluish-green cloth, and here comes in the embroidery, which goes all over it in a pattern composed of triangles and lines—not at all a difficult one to copy. It is worked in black wool, the triangles filled in, and the lines outlined. It will be found better to cut out the coat a plain, tight-fitting shape, embroider it, and then sew it together afterwards. It might be lined either with thin silk or muslin.

The skirt is full, made of black cloth, with a scarlet hem, also of cloth. The apron is dark blue, and not of cotton, as we have them, but of cloth. On the cloth is a pattern of fine white lines, which may be suggested by cotton threads run evenly through the surface of the cloth.

The pocket is the most fascinating detail. It is dark blue or red at the back, with a white front forming the pouch part, ornamented with pieces of the red cloth cut out in shapes sewn on with white thread; the stitches show and form white spots or crosses round the edge of the red shapes.

The cap is red satin, with yellow and blue flowers and leaves embroidered on it. It is in shape rather like our Puritan bonnets, but more open at the back, showing the hair well, and pointed in front.

The Swedish people are very fond of embroidery. Just notice how much there is on this one costume.

The shoes are black, with tongues and buckles, and the socks are white.

FILOMENA—THE LITTLE ITALIAN DOLL

IN beautiful Italy there are, of course, many classes of people, just as there are in our country, but it is only among the peasant class that we shall be able to find a typical or distinctive costume. The town folk dress much as we do. The dress we can see in the picture is one that would be worn by a little fisher girl. Her name is Filomena. When buying the doll, we must try to find one with dark hair and eyes and an olive-tinted complexion, because we have to represent a little girl who spends many hours of her time in the open air and bright sunshine. So she must have a brown skin, and a pretty pink color in her cheeks.

To describe the frock, we will start at the top with the head-dress, which is made of a square scarf, either white or any gay, light color. We will choose red with an orange and blue border. It should be folded cornerwise, and placed on the head with the two corners which come together hanging down at the back, and the other two—which are folded in half—hanging at the sides. The side-pieces are then raised to the top and secured there with a fancy pin.

Next comes a pair of red coral ear-rings, and a coral necklace to match.

Filomena's blouse should be made of fine white lawn, made very simply, and gathered at the neck into a narrow band. The sleeves are long and full, and are finished with a narrow cuff. The skirt is made of the same material, trimmed at the hem with a couple of rows of bright scarlet braid. The skirt should be made full and loose.

The little corselets, which are quite a feature of all Italian peasant costumes, are made of black velvet, and drawn together with red laces. We shall not find these difficult to make. We should fit them to our doll, make a little seam down the centre, if necessary, stiffen them with lines of machine-stitching, so that they will keep quite firm, and work eyelet-holes to thread the laces through. The stockings are of white cotton, and the boots of untanned leather.

DOLORES—THE LITTLE SPANISH DOLL

SPAIN is very often called Sunny Spain, because the climate is warm, bright, and full of sunshine. People who live in hot countries always love bright colors about them, in their houses and streets, and on their dresses, while people in colder places generally wear greys, black, and dark colors, so that we must find for our Spanish doll some very bright pieces of material. She will represent a dark girl, tall, and of graceful carriage. The women of Spain are noted for their beauty, and have dark, flashing eyes, so we must try to find a doll to fit these requirements. She must have plenty of dark hair, as it has to be "done up."

This costume is one which would be worn on fête days and holidays by a girl from thirteen to fifteen years old. At other times the girls dress very much as we do. The most noticeable feature is the shawl, which is always brightly colored, and has all round it a deep fringe, knotted at the edge and made of fine black silk.

We must get a square piece of soft silk, brightly colored and patterned. For instance, an orange ground with red and green flowers on it, or a pink ground with a small pattern in purple, deep red, and blue would do. Sew the fine black silk fringe all round the edge, and the shawl is made. We must fold our shawl from corner to corner, and put it round the doll's shoulders, as shown in the picture, crossed in front, with the ends loosely tied behind. Notice at the same time that the fringe is a deep one in proportion to the size of the shawl; also that it is knotted at the edge joining the shawl.

The bare throat should be decorated with one or two rows of colored beads.

The skirt is a shape such as we ourselves wear, made with a frill at the hem, and just short enough to show the ankles. The frill should be put on in little box-pleats, as shown in the picture.

The stockings are white, the shoes black, held on by the pretty little cross gartering, which can be made of narrow black silk or velvet ribbon. An end of the ribbon should be fixed to each side of a shoe, bring the ribbon round, cross it in front, and tie as shown in the picture.

The cotton apron is striped in several colors—it might be blue, green and red, or perhaps a pink one with mauve stripes; certainly it would be very bright.

The hair, a very important item, must be dressed high up on top, and should have a very tall comb stuck in behind, which shows from the front. A rose of deep red or bright pink will be stuck in on the left side.

It will, perhaps, be impossible for us to get a back-comb in a size to fit the doll. As it is a very necessary feature of the costume, here is a suggestion. Get an ordinary back-comb with an inch-wide top and fine teeth—perhaps one somebody has discarded because a tooth has broken can be found. Combs can quite easily be cut with a sharp penknife, and the edge smoothed with sand-paper or a nail-file. So with a little patience we shall not find it a hard task to make a back-comb to fit our doll.

Sometimes the Spanish girls wear a lace scarf to drape the hair; this is called a mantilla. It looks very charming indeed, but it is not usually worn with a fringed shawl; it accompanies a costume more like our own—that is, a dress with a bodice and skirt as we wear them. It takes the place of a hat, and is always worn at a bull-fight, the most popular entertainment in Spain.

PANNA—THE LITTLE HUNGARIAN DOLL

AS in most other European countries, so in Austria and Hungary—it is only the peasants who still keep to their national dress. In Hungary they wear a costume like that of the little girl in the picture. It is very charming indeed, and belongs to the part of Hungary called Croatia. We will call our doll Panna. She will have a happy little round face, with a healthy color, brown hair, and laughing eyes.

Her cap, or bonnet, which we will describe first, is one of the prettiest head-dresses imaginable. It is made of hand-woven cotton or linen, white or cream, and embroidered very beautifully in the brightest red, green, and violet silk it is possible to buy. The shape of the cap is very simple, for it is only two straight pieces of material.

The embroidery to be used on the frock and bonnet, of which we give a design on this page, must be copied as accurately as possible, because it is a very important feature of the costume.

The bonnet is worked in two shades of geranium-colored red—a deep, bright scarlet and a very pinkish red. These are not colors which *we* should put together, but they are extremely becoming to the wearer. The dark parts in the design given are filled in with violet and a soft greyish green. The silk used is thick and bright. The background is filled in with red, so that no material shows between the pattern.

We must use the design once for the back piece, and repeat it twice for the front of the cap. Join up the pieces which we see on page 3437, where the letters coincide—A B on the back to A B on the front, and C D on the back to C D on the front. The little hole which is left is filled in with lace stitches, the effect being very like drawn-thread work.

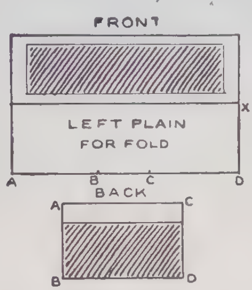
The pattern for the embroidery.

The most curious part of the cap is the "fold." The part from X to D is doubled back, bringing the embroidered half of the front to meet the back of the bonnet, and hiding the plain half of the front altogether.

The lace at the edge is of woven brown thread, of a more or less unbleached color, and it is put on just slightly full.

For the skirt and blouse white cotton is used, embroidered all over in a spot pattern. Cross-stitch is used, and the colors are black and red. Note well how the pattern is arranged in the picture, and also observe the shape of the skirt and blouse. The sleeve is finished with a frill at the wrist, and the skirt is just gathered into the waist.

The coat, which is quite plain in shape and without sleeves, is made of dark blue cloth lined with red silk. The edging is a strip of white cloth "pinked" out to form a border, and put on in between the lining and stuff, so that it stands out all round the edge of the coat. It only differs from the ordinary pinking which we have on our lamp-shades in the little hole in each point. The two rows of very tiny buttons are silver in color, and very bright.



The bonnet pattern.

The little apron matches the dress in color and material, except the border which edges it, and which is used again a few inches higher up.

The sash is a woven wool, or cotton braid, in bright colors—we call it "galon."

Panna wears a necklace of big red and black beads, threaded alternately—first a red and then a black, and so on.

SARAH—THE LITTLE ARMENIAN DOLL

THE complexions of the Armenian people are olive, the hair black, the eyes dark, and the women are noted for their long lashes. Altogether they are considered a handsome race, though their features are large. Our picture shows a little Armenian girl whose duty it is to fetch water in the beautiful earthen pot which she slings over her shoulder by a cord—for there are no water-pipes in Armenia.

Her costume is of cotton material—it is hot in the country where she lives, so she will not dress in thick material; the skirt is full, and hangs in flutes all round. It is cut several inches off the ground in length, and shows her bare feet and ankles.

The stuff is beautifully patterned in rich colors in what we usually call the "pine pattern." The little bodice which joins the skirt (they are sewn together at the waist) is a plain, tight-fitting affair, with long sleeves coming to the wrist, where they fasten with a small, plain cuff. It has no collar, and it is fastened in front with a few buttons. Over this she wears a coat made on the same principle as the costume. It has a full skirt joined to a plain top. The coat-skirt is shorter than the dress-skirt, and the coat-sleeves are short, coming to the elbow, and finish with a narrow frill of the material, which, by the way, is a dark blue or dark purple cotton.

Over the coat she wears an apron. There is plenty of stuff in the apron, but it is all gathered in so closely that it does not cover up much of the front of her dress. It is made of white cotton with a wide border of blue or patterned material.

The head-dress is very simple—just a brightly colored handkerchief or square of cotton folded round the head.

AHWEAH—THE LITTLE ESKIMO DOLL

WE all know where the Eskimo people live—right up near the North Pole, where it is always cold, and the winters are long and dark. It will not take us long to guess, when we think of this, how these people are dressed. Of course they are wrapped up in fur, because there is nothing else in the world which keeps one so warm and cosy as fur does. The people are very strong and rather plump. They are decidedly small in stature, and have small hands and feet. Their complexions are swarthy—by that we mean, of course, that the skin is a pale yellowish brown—and they have broad, flat faces, with eyes that slant in a way that reminds one of the Japanese or Chinese.

The strangest part about the Eskimo costume is that the men and women are dressed alike, both wearing trousers, boots, and gaiters. The only difference is that sometimes the lady wears a few beads.

The garments themselves are quite plain in shape, and the only ornamentation is a white skin sewn into the middle of the front. A pointed piece of fur, either cut from the tail or head of the animal, makes a sort of little tab or finish at the bottom of the front of the coat. The cuffs are white, too, to match the front piece.

The hood is a warm, tight-fitting one, coming closely round the face, and it has a little point sticking up behind.

The little girl shown in the picture, whose name is Ahweah, wears, of course, trousers to keep the cold from her legs. They are stuffed inside the top-boots, which are made of leather, with good stout soles to keep the wet out. The gloves are of leather, too, and have a thumb-piece only, like a baby's gloves.

Her hair, which is jet black and very straight, is plaited into two tails as soon as it is long enough. In the front it just hangs in little straight pieces over the forehead, and is decidedly irregular in length. The Eskimo boy has his hair cut off in a straight line across his forehead, a short distance above his eyebrows, but the back grows long just as his sister's does.

LITTLE DUTCH DOLLS—PIETER AND WILHELMINA

BEFORE we begin to dress these dolls we must look at the picture very closely. We shall begin with the boy doll. This costume is very easy to make, because it is a very simple one, both loose and comfortable as well as warm. We shall see that he has extremely baggy trousers, reaching to the ankles. These should be made of dark blue cloth, and cut very full indeed. His coat is of dark grey cloth, buttoned up to the neck. Underneath is a red striped waistcoat, the collar of which can be seen just peeping above the coat. At the waist are worn two silver buttons, always as big as can possibly be afforded. Sometimes they are like small saucers, and stretch right across the body, but most little boys can only get them the size of a half-dollar.

At the throat the red waistcoat is fastened with two gold-colored buttons, and the buttons which fasten the coat are of silver. The buttons of a Dutch boy are his jewelry, and a very important thing with him.

Pieter's hat is a felt or cloth one, round in shape and fairly tall, but with no brim. This must be made to fit his head. Cut a small circle of cloth for the crown, and to this join a straight piece—that is, a strip *as long as the circle is round*. Then make the join as invisible as possible, and the cap is complete. These hats are like a thimble in shape, tapering a little towards the top.

The wooden shoes—sabots, they call them—can be made out of thin cardboard or canvas, glued together, if we cannot find a pair of real wooden doll's sabots. They are often to be found for sale in toy-shops, however, and are quite cheap.

Pieter must, of course, be a boy doll, with short hair. The hair ought to be straight. He is fair, and has a healthy, "fresh-air" complexion.

The little Dutch girl's cap is made of white lace or embroidered muslin. It fits tightly to the head, and has wide side-pieces, which turn back from the face and form flaps, or "wings." These caps are stiffly starched to make the wings stand out, so we must make ours of stiff muslin. If we use lace, we shall have to insert a fine wire at the edge or it will not stand out.

The bodice is tight-fitting, with elbow-sleeves. The square vest in front has an inner chemisette of white, and is bordered with a band of plain or differently colored material from that of the bodice itself, which is a patterned cotton. Round her throat the Dutch girl wears a handsome necklace of corals, several rows held together in front by a large gold clasp.

While in America the women try to look slim, the Dutch lady, to be really well dressed, must look as big as possible. She must try to appear quite fat, and the more woolen petticoats she wears the better! It is the fashion in Holland to have a lot of petticoats. The skirts only come to the ankle, and the petticoats are cut the same length, so that when she walks the Dutch girl swings her skirts to and fro, and the petticoats can be seen. The richer the lady the more petticoats she wears. Therefore, we must make our doll plenty of thick petticoats and a dark cloth skirt. Make them all very full, gathered in all round the waist.

The apron, which should be white or blue, has a piece of check material at the top. We can see how this is done in the picture. Notice that there is no bib as we have, and that the fastening is a plain band, very narrow, buttoning at the back. The sabots are the same as the boy's, and an American doll, either dark or fair, will represent Wilhelmina.

We should remember that there are very many different kinds and colors of costumes in Holland, some, of course, much more elaborate than these, but they all bear a "family likeness" to the Dutch costumes described here.

The Dutch people wear, perhaps, the quaintest and prettiest costumes of any.

IVAN—THE LITTLE RUSSIAN DOLL

RUSSIA is such a large country that in different parts of it the climate varies from quite hot to quite cold. On the whole, however, it is considered a cold country, and in Petrograd, the capital, they have very severe winters; they are so cold that the river freezes over until the ice is strong enough to bear the weight of horses and carts. Then people bring out their sleighs and carts specially fitted with flat pieces of steel, like huge skates, instead of wheels. These glide along the ice road made by the frozen river, going along at a tremendous speed.

It is easy to understand that people need very warm clothes for these ice journeys; in fact, everyone who can possibly afford it wears furs.

Not only is the hair of the fur warm, but the leather from which it grows also keeps out the cold. And so we are going to dress little Ivan in fur.

We must get a little boy doll, with short hair; in fact, one just like a little American boy in hair and complexion. First of all he will wear a little navy-blue sailor suit, like those our boys have, but he will wear top-boots with it.

We shall be able to make these out of a piece of soft kid or leather. Notice the shape of them.

Next we come to the overcoat, which is like ours in shape, but lined and trimmed with fur. The fastenings are "froggings" of black woolen braid, and arranged as shown in the picture. Any dark thick cloth will be suitable for the coat. The collar and cuffs are made of long fur, and the lining of a shorter kind.

The little cap, round in shape, fits closely to the head, and is made of fur to match the collar and cuffs.

Little Ivan's costume would not be complete without gloves; in such a cold climate the hands must always be carefully protected.

LOTUS BLOSSOM—THE LITTLE JAPANESE DOLL

THE costume worn by the little Japanese girl is one of the most beautiful in the world. The Japanese are great artists; they are wonderful at making exquisite objects out of simple, cheap material. They excel in this point, and we find the idea carried out in their garments. They have, too, a great love of color, and, by some instinct, they seem to know how to blend colors in a most wonderful way. So that we shall find their clothes simple in shape, made from almost straight pieces of material—and not much of it. We shall also find the colors very beautiful and well arranged.

Now we will find out how to make the costume shown in the picture for Lotus Blossom, which is the English translation of a real Japanese girl's name.

The Japs are passionately fond of flowers; they give the children flower names, and a large number of their dresses are made in material with flowers upon it.

It is quite easy to buy Japanese printed cotton at any large dry-goods store. We must be sure that it is real, and not an English imitation, for there is a great deal of difference. The price will be less than a quarter a yard.

Perhaps at the same shop we shall be able to buy a Japanese doll, with almond eyes and black hair.

The shape of the dress is very simple—very much like our dressing-gowns, though the sleeves are different. They are long and straight in shape, and have deep pockets in the end which hangs down. The little owner keeps all sorts of things in here beside her handkerchief.

Let us suppose that we have bought a pale green material with branches of flowers, pink, purple, and grey, trailing across it, and here and there lines of black and gold.

A little fold of purple silk—a slightly deeper shade than the flowers—will just show where the gown crosses at the neck. For the sash we must get a piece of stiffer material—Japanese brocade or gold tissue.

The Japanese girl thinks a great deal of her sash, and is very particular about the way it is tied behind. It should be very wide in front, folded at the back with one loop going up and another going down, threaded through a crossway piece.

Lotus Blossom wears wooden shoes with short stilts that fit into holes in the bottom. She fixes in these stilts during rainy weather to keep her feet off the wet ground.

To dress the hair of a fashionable girl generally takes about two hours—never less, and often longer; it is not surprising, therefore, that the hair-dressing is expected to last for two or three days!

A great variety of combs is used, and plenty of pomade to form the hair into shapes before it is finally fixed. A Japanese girl does not wear a hat in the street—she carries a paper sunshade. We can buy one (doll's size) at a toy-shop.

CHANDI—THE LITTLE INDIAN DOLL

IN our collection of dolls we must certainly have one to represent India. Among the natives of that country we should find a great many different kinds of costume. The class distinctions are very great, and the costumes of each class vary more or less. In our picture we see a nurse-girl, or ayah, as she is called. Her name is Chandi. We see that she has bare feet. She would not wear shoes in the house—that would be considered very rude to her mistress. Just in the same way that an American lifts his hat here, an Indian removes his shoes before entering a house. When in the street Chandi would wear a pair of loose, heelless slippers, made of goat-hide, with turn-up toes and no fastening.

The dress is made of woven cotton material, yellowish in tint and soft in texture. The bodice is like a tunic in shape; it hangs outside the skirt, and comes three or four inches below the waist-line.

It is plain in shape, buttoning up in front with three sets of small buttons, each set containing two buttons.

On the hips at each side the bodice is cut up a little way, and a small piece of the material is inserted to make the garment fuller. The sleeves are plain and fit tightly to the arm, coming only to the elbow. A piping of scarlet cotton edges the neck, the sleeve, and the bottom of the bodice. The Indian woman is exceedingly fond of decorating her costume with a piping of bright color.

The skirt is made of the same material. It is cut very full and pleated into the waist with a great many pleats; it is cut short enough to show the ankles.

The rest of the costume is composed of a strip of material bordered with a band of scarlet. This piece is draped round the figure and over the head, taking the place of a cloak and hat. To arrange the drapery we must start by tucking one end in at the waist in front; then we must twist it round over the back of the head, and bring the other end over the left shoulder. The ayah holds this in position with her hand as she walks.

She wears many metal bracelets, and on each foot is a metal anklet, one inch wide; they clank together as she walks. A similar piece of jewelry clasps her neck—fastened as old-fashioned bracelets were, with a hinge and a snap at opposite sides of the circle. Her next piece of jewelry is quite easy to make. It consists of very large ear-rings, made of clay or mud, which, while soft, has had stuck into it a number of brightly colored beads, carefully arranged in a pattern composed of either circles or diamond shapes. These ear-rings are so heavy that they are supported by a chain which goes right round the ear.

Chandi's hair is black and very shiny, and is quite straight. It is parted in front and brushed down behind the ears, to be fastened, without hairpins, in a tight knob at the nape of the neck. Her complexion is deep brown all over and her eyes are dark.

WHAT TO DO IN TROUBLE

DUST OR GRIT IN THE EYE

WHEN a little speck of grit or dust gets into the eye and no one is at hand to take it out for us, there are several things we can do. If we feel that the speck is moving about, we can first try shutting the eye a minute. Violent blowing of the nose will sometimes bring out the speck; so will tears. We might take hold of the upper lid with the thumb and forefinger and work it gently over the eye towards the nose. If the speck gets fixed on the surface of the eyeball we can dislodge it in this way, or by passing a moistened fine camel-hair brush or the corner of a handkerchief over the surface of the eye, using a looking-glass, of course. Bathing the eye with cold water, and opening it in cold water will take down the inflammation; so will a cold-water compress. A solution of boracic acid is also a good remedy. If a spark from a cigar or a piece of hot ash enters the eye, a drop of olive or castor oil will ease the pain. It is bad to rub the eye.

SOMETHING IN THE EAR

When by accident an insect flies into our ear we should try to coax it out by turning the ear towards a bright light. So if a bead or hard substance gets in, we risk destroying the drum by poking the bead against it. If we pour water in to try to wash a pea or other seed out, we might simply make it swell in the ear. The proper thing to do is to hold the ear downwards and gently pull at the lobe. If that fails, we must get someone to syringe the ear, or go to a doctor.

TO STOP THE NOSE BLEEDING

If the bleeding is only slight, we can sniff cold water up the nose, apply a handkerchief dipped in cold water to the root of the nose, sit in a chair with the head back, and place a key or a piece of steel at the back of the neck. We should *not* bend down over a basin. If the bleeding is in a constant stream we should send for ice, lie flat, and plug the nostril with a screw of wet rag, until a doctor comes. The collar should be loosened, the hands held above the head, fresh air breathed, and a hot-water bottle applied to the feet.

HOW TO TREAT BRUISES

A blow or a tumble may cause a painful and unsightly bruise, which hurts much at the time and turns purple, black, greenish, and yellow, due to bleeding underneath the skin. One remedy is to apply something cold, whether it be ice, the blade of a table-knife, or a cold-water bandage. Sometimes bathing with very hot water for ten or fifteen minutes will give relief. A bruised limb should be rested. Arnica and water—one teaspoonful of arnica to a teacupful of water—are soothing when the skin is unbroken; when it is broken, witch-hazel may be applied, but the surface must first be washed free from dust or gravel. Should it be much grazed, it must be bound with a clean handkerchief to exclude the air. If the wound is severe, cleanse the surface with equal parts of hydrogen peroxide and water, and apply zinc oxide ointment on a piece of sterilized gauze.

STRAINS AND SPRAINS

We "strain" the wrist when we overstretch its tendons or muscles. We "sprain" the ankle or "go over" it when we stretch or tear the ligaments of the joints in that part of the foot. A sprained ankle may disable us for months, and it is unwise to try to walk with it before it is completely cured.

Hot fomentations should be applied to cure a strain or sprain—that is, we lay on the part a cloth dipped in water as hot as we can stand; then we apply a cold-water compress covered with oil-silk and bandaged with gauze in the proper way, and rest it.

WHEN A BONE IS BROKEN

If the bone of a limb be broken, the limb is powerless. Should this happen to the leg, we must not try to move it, but wait till someone comes to lift us on to a stretcher, shutter or door. In doing this a rug or sheet should be carefully passed under the legs and these raised and lowered on to it. The injured limb can be lightly tied to a stick or umbrella which may be at hand, to give it support and prevent the broken bone piercing the skin. When the arm is broken a sling should be made for it out of a large pocket-handkerchief. We can feel along the broken bone and keep the two edges as near as possible together.

BITES AND STINGS

If an unhealthy cat, dog, or any other animal, bites us, its saliva may poison our blood, especially if the bite is taken on a part unprotected by clothing. If the finger is bitten, we must at once bind it tightly higher up towards the hand, then suck the bite and spit out the saliva. As soon as we can get warm water we wash the wound; if it bleeds, all the better. Then we get it cauterized; a burning fusee has done duty when proper cauterizing was impossible The bites of insects are relieved by applying liquid ammonia or rubbing with a lump of moistened washing soda.

The sting of the bee can be removed by squeezing the part, or pressing a ring on to the surface, to force the sting out.

THORNS IN THE FINGERS

If we cannot seize the splinter or thorn with the thumb and finger of the other hand or with a pair of tweezers, we must get a fine needle—a *needle*, not a pin—and tear open the skin in the direction the thorn entered. Then we stroke it along with the needle towards the opening, squeezing the finger towards the same point now and then, and also sucking it to draw out the thorn.

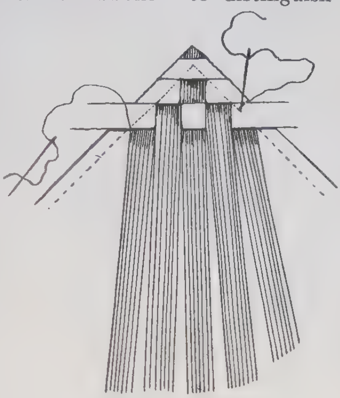
FALLING INTO WATER

If we tumble into a river, lake or sea, the worst thing we can do is to throw up our arms, try to breathe under water, and struggle and scream away all our strength. If we cannot swim we can at least keep our presence of mind and remember that water will float us if we lie quietly on our backs. So we lie flat with the hands down and call for help. If a rope is thrown or a stick held out to us we seize that and are drawn to shore, but if someone swims to the rescue we must be careful not to grip that person round the neck, shoulders or waist, and drag him down under water.

A CUSHION-COVER MADE WITH PLAITED RIBBONS

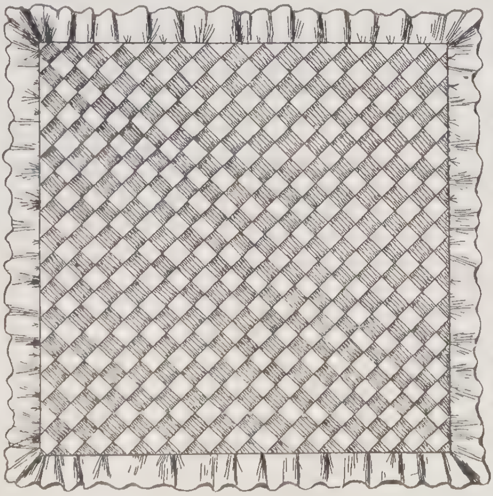
RIBBONS are now obtainable in many shades of color and in several materials. Besides being used for the ribbon embroidery work, they may be plaited. We propose to make a cushion-cover with plaited ribbons, a dainty one which is suitable for a drawing-room chair or a porch-swing. We shall want two different colored double satin ribbons ⅜ of an inch wide. Two colors which combine well are pink and pale green. Other combinations of colors look well, such as pink and grey, heliotrope and violet, cream and bronze, or three shades of blue or of green, the choice being determined by the prevailing color of the furniture and decoration of the room the cushion-cover is to go into. The quantity required depends upon the size of the cushion. The half "piece" of 18 yards is enough.

We intend using the plaited ribbon on one side of the cushion only. The back of the cushion-cover will be of cotton-backed satin or sateen in plain pale green or pink, to match one of the ribbons.



1. Starting the plaiting.

Having cut out the silk for the back of the cushion-cover, we set about arranging the ribbons. Picture 1 shows how the two ribbons are plaited together. The pattern is simple enough, but care is needed to lay the ribbons down across the cushion evenly, and to cut them precisely the right length, so that none is wasted. The longest strips are laid across from the left top corner to the right bottom corner before plaiting begins. The ends are shown loose in the picture. Suppose we start with a pink strip in the left top corner. We stitch this down to the back of the cushion-cover and lay a piece of the green ribbon over it, stitch the two ends down on the left side and on the right, and cut off both ends close enough up to leave room for stitching on a frill or braid later. This is the shortest length of green ribbon we shall use; but the pink one underneath goes right across the cushion to the opposite corner.



2. The finished cushion-cover.

In the next row two pink ribbon lengths are started, and a green ribbon is plaited over them both, and under the first one coming from the corner. As we proceed we plait more and more, each row, until the top and left sides are ended, and then plait shorter and shorter green lengths till the bottom and right sides are finished.

It should be said that the pink ribbon appears darker than the green in the picture, to distinguish between the two. The edges of the ribbon lengths should just touch. It will be found that the ribbon should not be cut till it is stitched down, that the stitches must be small and neat, and that the ribbon must be cut slantwise. The corners will need special care, for here, if anywhere, the ribbon is liable to bulge and refuse to lie flat. But a little coaxing and the use of a sharp pair of scissors should bring about a good result. Two needlefuls of silk will be in use at the same time, one for the left side and bottom, and one for the top and right side of the cushion. Nowhere must spaces appear in the plaiting. The ribbon has to cover the whole surface, but it must not be stitched on to the cushion anywhere.

When the plaiting is completed we make a frill of silk to match the green or pink, and run it on to the cut ends of the ribbon, round the edge of the cushion-cover on its under side, so that the stitches are invisible from above. Now our cover should look like that shown in picture 2. If preferred, a silk cord can be run along the edge instead of the frill, and loops of it made at each of the four corners of the cover. This plaited work can be done with colored ribbon or braid, and the back of the cover can well be made of sateen. This would, of course, cost less than the cushion-cover described above. But, whatever materials be chosen, the ribbon should not be too flimsy, or we may be quite sure that it will wear out quickly, and all our work be lost. We can make other articles in plaited ribbon-work, such as handkerchief-sachets, tea-cosies, nightdress-cases, mats, and table-centres. Wash-ribbons are now manufactured, so that there need be no fear of the article being spoiled in the laundry.

A LITTLE VEGETABLE GARDEN

WHAT TO DO AT THE END OF MAY

IT may be that tomatoes are among the things that we have set our hearts on growing. For inexperienced young gardeners the best way to proceed is not to attempt to rear the plants from seed, but to buy a few young plants—a quarter will probably buy more than we need—and they should be ready to plant in the open after a few days' hardening off. This process is very necessary, as they will have been grown under glass. We will stand the pots a few days in the open, and protect them at night if the weather be unfavorable. After that we must choose a warm, sunny position, and there is nothing better than the foot of a wall looking south. The soil should have been well dug and a little stable manure put at the bottom of each hole, then a layer of soil above it. The hole should be large enough to take the roots quite comfortably.

The usual plan nowadays is to grow only one stem, and even from this the side shoots must be pinched out. The young plants for a time should be watered in the morning rather than the evening, but too much water should not be given, or it may happen that we get luxuriant foliage and not so much blossom as we desire. All the same, the plants must never suffer for lack of water. If the little gardens are full already, or there is no favorable position for the plants, good specimens may be grown in large pots, in boxes, or in lard-tubs.

Soot-water is excellent to use sometimes in turn with clear water and manure-water for our plants. It may be helpful to know how to prepare it. We want some large tub or other vessel, and we tie up our soot in a bag of some coarse material. Lay a thick stick across the top of the vessel, and with a bit of strong string suspend the bag so that it is below the surface of the water. If the water is very deeply colored we can add some clear water before using, for it must not be used too strong.

It is difficult to give the exact date when to transplant young greens from the seed-bed, so we will say when they are about three inches high. Perhaps we are hoping to grow them on the ground now occupied by the early potatoes. In that case there is some time to wait, for the potatoes are not yet ready to be lifted; but, rather than let the little broccoli and other greens be closely crowded together, we may prick them out a few inches apart on some small bit of spare space, and plant them again to the proper distance apart as the ground becomes vacant.

Do not let us forget what has already been said as to growing lettuces successfully—they must never lack moisture.

The summer is the time for shows and exhibitions, and if we want to exhibit we must prepare for it a long while beforehand by seeing that our vegetables have especial attention. In arranging a dish, let us say, of potatoes it will not answer to pick one two, or three very large specimens, and the rest very much smaller. We ought to aim at a uniform size, as far as possible—a good even lot—and this applies, of course, to most of the subjects. Suppose we are arranging a basket of vegetables, then let us use plenty of parsley as a background; it helps to make the vegetables look inviting and tasteful.

We may plant out the half-hardy annuals that we have been rearing in boxes, or may choose to buy at this season. In fact, the last week in May is the time when we should fill all vacant places in the flower-beds with plants to make our garden bright and beautiful during summer. In some cold districts cannas, begonias, and dahlias that have been started under glass are generally not trusted to the open until the first week in June.

After everything is in place for the summer it is rather a good plan, if needed, to put a little clean, fresh gravel along our garden path, and to see that the edging, whatever it be—box, or stones, or tiles—is quite trim.

Now that the spring flowers are over it is a good thing to remember that plants are weakened if we let them ripen their seeds, so these should be cut off at an early stage. We may sow the seeds of wallflower for next year at any time from now onwards.

ANSWERS TO THE PICTURE PUZZLES ON PAGE 3320

1. The nut-crackers are on the grapes, and the grape-scissors are among the nuts.
2. The handle of the pump is on the left instead of on the right of the spout.
3. The positions of the knife and fork, in relation to the plate on the table, are reversed.
4. These scissors have no centre-screw to join the two parts together, and act as a pivot.
5. The handle of this railway-carriage door is on the side next to the hinges.
6. The flag is waving against the wind, the direction of which is shown by the driving clouds and the bending trees in the distance.
7. The trigger of the revolver is the wrong way round.
8. The rose is growing on a vine tendril, as is shown by the shape of the leaves.
9. The football-player is playing the Rugby game with a round Association ball. In Association, the players are not allowed to handle the ball; the Rugby ball is of an oval shape.
10. The sword which the warrior wears is buckled on to his right side, whence it would be difficult to draw it with his right hand.
11. The train is running past its signal, which is set at danger.
12. The horn of this motor-car is out of easy reach of the driver.
13. The hour of four on most watches is indicated by the old sign IIII, instead of IV.
14. This motor-van has no number at the rear, as required by the law of the land.
15. These two trains are running side by side, though there is only a double set of rails.

WHAT IS WRONG IN THESE PICTURES?

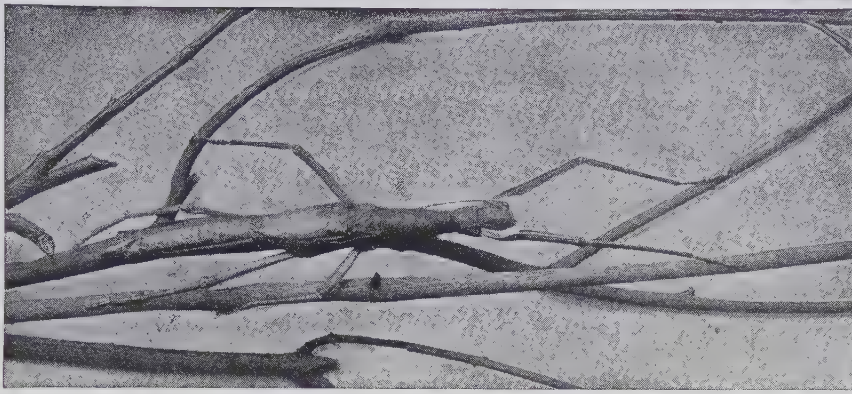
There is something wrong in each of these pictures. It will help us to cultivate our powers of observation to try to discover the mistakes the artist has purposely made. They are pointed out on page 3558.

THE NEXT THINGS TO MAKE AND DO ARE ON PAGE 3551.

ANIMALS THAT CHANGE THEIR COATS

A most remarkable thing in nature is the way in which animals are protected from their enemies. This picture shows us a group of animals that live on the hillside and among the heather in cold countries. The fox, the ptarmigan, and the hare are colored like the heather and rocks, and can hardly be seen.

In this picture we see the same animals when the winter has come and snow is on the ground. Their fur or feathers have turned white to match! This happens only in very cold countries, and the purpose of this remarkable plan of nature is to prevent the enemies of these animals from seeing them.



A stick insect that in color and form looks almost exactly like the twigs on which it rests.

ANIMALS WITH WONDERFUL COATS

CONTINUED FROM 3364

THERE is an old joke known to nearly all of us who have been to a circus. Two clowns enter the ring, and one says to the other: "Do you know how to catch a rabbit?" "Why, how should I catch a rabbit?" asks the other. "The best way to catch a rabbit is to sit behind a hedge and make a noise like a turnip," says the first clown in reply.

Now, none of us would play such a trick upon our friends as to say that in Nature's family creatures sit behind hedges and pretend to be turnips. That would be rather silly. But the idea of the old circus joke comes back to mind when we remember that insects perch on leaves and twigs, and pretend to be leaves and twigs. Shall we say "pretend to be"? No, that carries us too far. The wonder of the structure of the insects is sufficient as it is without our letting fancy run us into the danger of overstepping the bounds of common-sense.

The leaf insect and the stick insect are among the most wonderful examples of what we call protective mimicry, but we must not say that the insect deliberately plans its own color. It would be just as incorrect to say that the ptarmigan deliberately changes its feathers to white in winter, or that the mountain hare deliberately alters the color of its winter coat to match the snows among which it lives. It is by one of the great mysterious processes of Nature that these humble insects are able to make themselves like their surroundings; and it is by the operation of the same law that the giraffe and the tiger are able to become invisible among *their* surroundings.

The great white bear of the Polar regions did not get his white fur by thinking that it would be better for him to have a coat matching the snow of his native land. Man is the only living creature that can deliberately do these things. Man has a mind; he remembers yesterday, and last year, and the years before that, and he plans for the years that are to come. None of the creatures of the wilds are wise enough to copy the arts of man. Man, however, copies the animals.

One of the things that the lower orders of creatures have taught us is protective mimicry. In the old days, when soldiers went forth to war, they wore glaring bright uniforms. These showed up distinctly against the grass and rocks among which they had to fight. Nowadays, when we send out our soldiers to war we dress them in an inconspicuous uniform called by the Indian name khaki—a material which looks like the color of the earth and rocks. We even paint the bright parts of the guns like khaki, so that they shall not glisten and

prove a mark for the sharpshooters of the enemy. This is a recent change in war, but in the lives of the lower creatures it has been practised for perhaps millions of years.

It has not come suddenly. It was not done in a day or a night, nor in a year. Take the case of the humming-bird moth. That is so marvelously like the humming-bird that men have shot it in mistake for the bird. That seems rather a queer sort of "protection" for the moth. But those moths were there long before men and guns appeared. In the old days they were persecuted by insect-eating birds and other creatures. Then perhaps one or two moths were born different from the others. They were perhaps larger, and looked a little like a humming-bird. Their likeness to the bird and their larger size would lead to their being spared by birds, which mistook them for birds instead of moths. Naturally, then, the young ones of these would be like their parents, and would have a better chance of rearing young ones.

MOTHS THAT LIVE SAFELY BY PRETENDING TO BE BIRDS

Gradually the moths that were like birds, if they mated with moths like themselves, would become a species. They would survive the perils which the others could not avoid. The old stock —the moths which looked like moths— would die out, because the more the other moths increased, the more would those of the original type be sought as food. So in time the first strain would become extinct, and those which had imitated the humming-birds would possess the whole part of the country where the others had been. They would survive, because, by unconsciously imitating birds, they had deceived their enemies. Many learned people think this is how a large number of species came into existence.

And what is true of the gradual formation of the species of humming-bird moths is true also of the other wonderful creatures which live by trickery. Their art is the outcome of ages and ages of development. The improvement has come little by little, and the change of form, very slowly effected, has become permanent, because it is necessary for the very life of the creature benefited by it.

WHY ONE BIRD BECOMES WHITE IN WINTER, AND ANOTHER REMAINS BLACK

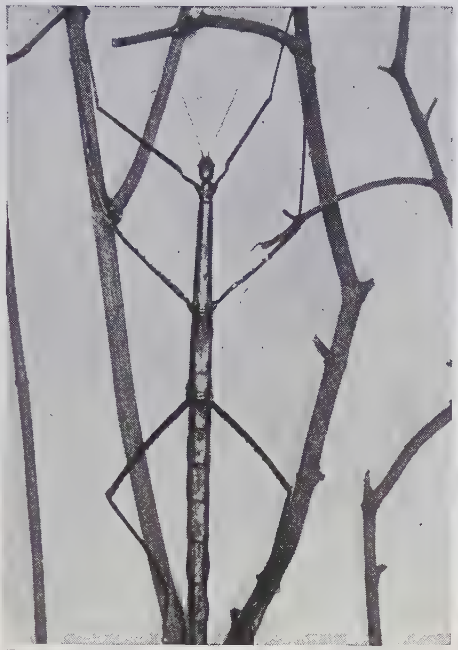
Those of us who have followed the BOOK OF NATURE from the beginning to the present point have noticed repeated instances of the manner in which animals, birds, fishes, reptiles, and insects are safeguarded in this way. On the other hand, careful observers will have noted that there are striking exceptions. It is only fair, when we are stating a general and important rule, that we should grapple, as far as we are able, with the difficulties which exceptions seem to present. Let us see if we can answer, in advance, some of the questions to which this story may give rise.

Why should a ptarmigan be able to change its plumage to pure white amid the winter snows, when the relatives in the Arctic snow of our friends, the ravens, have to show themselves in glossy black, winter and summer? That is a fair question. The answer seems to be this: that the ptarmigan has need of its white plumage in winter so that it may seek its food in safety upon moors and hills and mountains, without being discovered by its enemies, as it quickly would be, were it to wear its summer garb of colored feathers. The raven, on the other hand, does not seek its food from things growing upon the ground. It feeds on carrion, and is free to fly wheresoever it will. Therefore, it is not in need of protection such as is necessary for the very life of the ptarmigan. It need not fear death through being plainly visible on the snow.

WHY THE SABLE DOES NOT CHANGE HIS BROWN COAT IN THE SNOW

A stronger contrast, however, is presented by the Polar bear and the sable. The Polar bear lives in the Arctic regions, and the sable lives in bitterly cold Siberia. Siberia has a generous summer, but the cold there brings snow and ice in winter almost as bad as that of the Arctic regions. Why, then, cannot the sable change his coat to white in winter, instead of living always in the rich brown fur which is so famous and so costly? The Arctic fox and the ermine, like the bear, change theirs. The Polar bear, indeed, is white all the year round, the only bear to enjoy this distinction. Snow and frozen waters

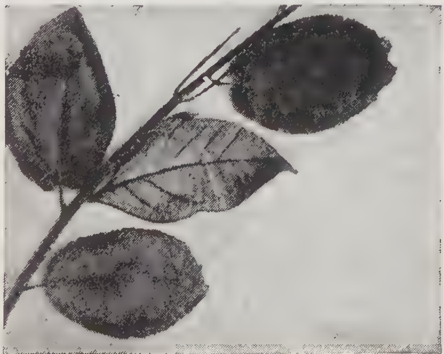
INSECTS THAT PRETEND TO BE PLANTS



The stick insects are among the marvels of Nature. As we may see from this one that is common in Ceylon, the creatures bear a remarkable resemblance to the twigs of the trees on which they rest.

Some of the stick insects are thirteen inches long, and yet so closely resemble twigs that it is often impossible to discover them even when looking straight at them. This picture shows an insect from Brazil.

Some of the largest stick insects are found in Brazil, but quite as wonderful is another insect common in that country that exactly resembles the thorns of the plants on which it rests, as may be seen in this picture



The upper surface of the wings of the Indian leaf butterfly is very gaudy and conspicuous, but when it rests it closes its wings, and is then, in shape and color, almost an exact copy of a withered leaf.

There is an insect in Mozambique that closely resembles a flower, as may be seen here. It pretends to be an orchid, in order to obtain food, for when butterflies visit the supposed flower they are quickly seized.

are always to be found in the Arctic regions, winter and summer, hence it would be a disadvantage for the Polar bear, which seeks seals and fish, to change his coat in summer. The Arctic fox, on the other hand, strays farther from regions which are always covered with ice and snow; so that it *is* to his advantage to change his color with the seasons.

How, then, about the sable? The reason that he does not alter his color in winter or summer is this: when snow and ice abound in winter, the sable has to seek his living in the bushes and trees. He is very hungry, and eats a vegetable and meat diet. In the bushes and trees he finds berries which help to make up his meal. He is thankful for these; but still more welcome to him are the birds which he is able to catch.

HOW THE CUNNING SABLE HIDES IN THE TREES AND CATCHES BIRDS

Now, if the coat of the sable were white, like the snow, he would be easily detected as he creeps along the branches. With his brown fur, however, he is not readily distinguished from the trees and bushes along which he makes his way. Therefore, being so protected from observation, he is able to pounce upon unwary birds that would otherwise be beyond his reach. It is his color that enables him to get the food necessary for his existence. If he were white, very likely he would starve, for berries alone would not feed him.

Then there is the musk-ox, whose dingy, shaggy coat is always plainly seen against the snow—whence comes his protection from color? The plainness with which he can be seen is not a source of danger to him, but of protection. Left alone, a musk-ox, gallantly as he might fight, would soon become the prey of savage, hungry animals. He may be brave, but he cannot alone resist the attacks of animals with powerful, tearing teeth. But a herd of musk-ox together might defy quite powerful enemies. Therefore, in case of danger, it is necessary that the musk-ox should be able readily to see his comrades, so that he may rush to them. He can easily see them in their dark coats, but he could not if their coats were white like the snow.

The stripes of the tiger melt into the background of his lurking-place, while the white under part of his body make it appear as if his bulk were only a deep shadow. The tawny coat of the lion can scarcely be distinguished from a rock, while the spots of the leopard and the jaguar make these beautiful but ferocious animals appear like moving shadows as they slink along in search of prey. These animals have acquired coats which help to hide them from their victims. But on the other hand the stripes of the zebra, and the spots of the giraffe are a defence to peaceful animals which live only on vegetable food.

A WONDERFUL INSECT THAT CAN MAKE ITSELF LOOK LIKE A LEAF

Having answered these questions, let us return to our insects, and see if the marvels of the leaf insects and stick insects stand alone in the story of Nature's miracles. We shall soon find that they do not. The leaf insects and stick insects seem to have reached the highest stage of perfection in protective mimicry, but the defences of other weak little creatures are found equally wonderful in their way. But let us first discuss these wonderful insects.

The leaf insect makes its home in hot countries, and reaches its greatest perfection in Ceylon. When you commence to learn science you will find that its learned name is *phyllum*, but we shall continue to call it the leaf insect. For its likeness to a leaf is so close that it completely deceives the Veddahs, a tribe of keen-eyed hunters who live in the jungles in the south-east of Ceylon.

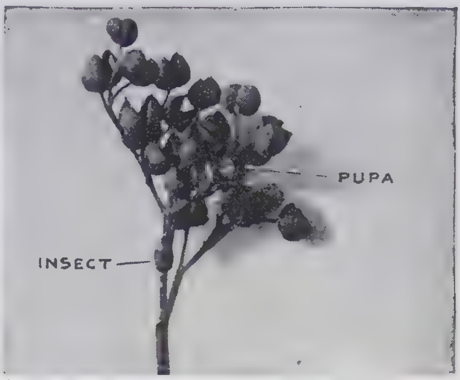
These simple, half-savage people believe that the leaf insect is really part of the plant on which they discover it. It grows like a leaf, they say, and is really part of the leaf for the early stages of its life, and then, when it reaches maturity, it loosens itself from the plant and flies away. Of course, that is a mistake. A tree or plant may feed an insect, but life comes from the Power which created the tree. We might just as well say that the caterpillar of the clothes moth is created by the cloth or fur in which it is born. But we can forgive the Veddahs for their error.

HOW THE LEAF INSECT DECEIVES THE CLEVEREST OF MEN

When naturalists first studied the leaf insects, they said: " To such perfection has Nature carried her arts in these insects, that you would declare, upon

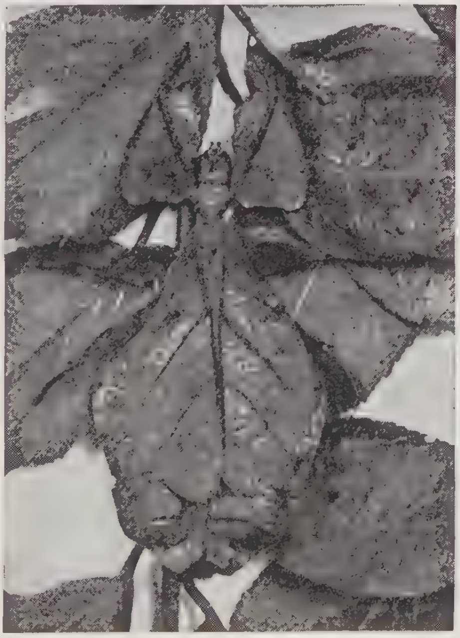
HOW INSECTS DECEIVE THEIR ENEMIES

Some geometrid caterpillars, like that of the waved umber moth shown here, are known as stick caterpillars, because of their habit of imitating twigs.



An English beetle that feeds upon the leaves of figwort, spins a cocoon that resembles a seed capsule of the plant for its pupa stage, and so escapes notice.

The comma butterfly, which gets its name from a white mark like a comma on its wings, is one known to every country boy. The underside of the wings varies through all the browns and dull greens of faded leaves, and when the butterfly is at rest, as shown here, it is difficult to distinguish from a dead leaf.



This leaf insect from Ceylon exactly resembles a leaf, not only in its shape and green color, but in its markings, which are just like the veins of a leaf.

Some beetles resemble the bark and lichen on which they rest. Here are two beetles from the East Indies which are difficult to distinguish from the lichen.

seeing some of the insects, that they had robbed the trees of their leaves to form for themselves artificial wings, so exactly do they resemble them in their substance and internal structure." Stick insects and leaf insects belong to the same family, but there is the same sort of difference between the two species that there is between the centipedes and the millipedes. The body of the stick insect is narrow, and shaped like a cylinder; the body of the leaf insect is broad and flat. The leaf insect is colored exactly like the leaves among which it rests. The abdomen is broad and flat, and green or dark yellow. If it lives among green leaves, the body will be found to be green; if the leaves be withering, the leaf insect will look just the same color as the foliage, dried up and withered, as it seems. The legs are broad and leaf-like, so that they pass for parts of the leaves. But perhaps the wings are the most wonderful. In every respect they resemble the leaf of a tree or shrub.

Let us study the picture of the green insect from Ceylon on page 3449. We can hardly tell where the real leaf ends and the insect begins. Down the centre there appears to be the main nervure of the leaf, and branching off to right and left there seem to be lesser nervures. The shading of the wing-sheaths is exactly like that of the leaf.

THE LEAF INSECT'S WINGS THAT CHANGE COLOR LIKE A DYING LEAF

How does the insect get this extraordinary resemblance to the leaf? The trick is effected by Nature, by means which might seem almost to justify the mistake of the natives. The coloring is the result of what is known as chlorophyll, which is the green coloring matter of plants. The formation of the elytra, or wing-sheaths, is similar to the construction of the leaf of the plant. The resemblance is not only on the surface, but, more wonderful, in the internal structure of the insect. Even when the life of the insect ends, the resemblance does not depart. One such insect which has passed its life among green leaves would always remain, when alive, green like the plants; but when it dies, the body of the insect changes color exactly like a dead leaf.

The food of the leaf insect which we have been considering is the leaf which it resembles. But there is another species of leaf insect which does not rely upon this sort of diet. This one, which flourishes in Mozambique, is a flesh-eater. Its food consists of butterflies and other insects. So the insect has to practise to deceive its victims into the belief that it is something else than a hungry, carnivorous animal. This it manages to do by imitating the orchid.

AN INSECT THAT PRETENDS TO BE A FLOWER AND FEEDS ON BUTTERFLIES

Its color and form resemble the flower of a beautiful orchid. It settles upon an orchid and remains quite still. Butterflies approach in the belief that the insect forms part of the orchid from which they desire to extract nectar. In an instant the insect starts up, catches the butterfly, and eats it.

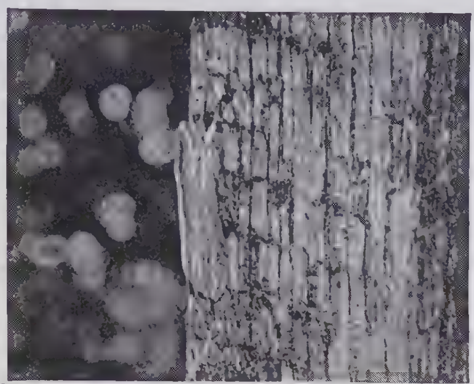
These two species of insects give us the story in a nutshell of the whole scheme of mimicry. One is colored to resemble plants, so that it may escape the attacks of stronger creatures which would destroy it. The other is colored to resemble a flower, so that it may be mistaken for something quite harmless by creatures upon which it depends for food. And throughout wild Nature this plan works in these two directions. The lion and tiger are colored to resemble their surroundings so that their intended victims may not see them; the humming-bird moth and the leaf insects, and all the lesser creatures that need protection, are colored and shaped so that they may go their way through life always being mistaken for something else by the things that would eat them.

After having admired the wonders of the leaf insect we cannot be more astonished by other creatures, but we have to admit that the claims upon our admiration of the stick insects are just as strong. They are as marvelously protected in their way as leaf insects are.

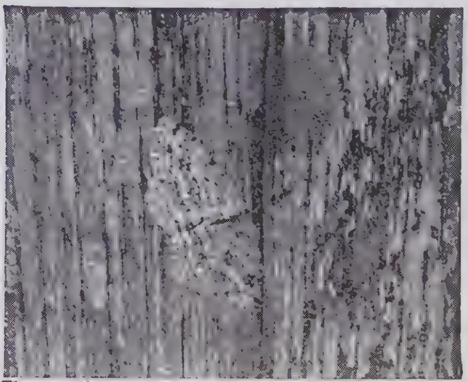
A WONDERFUL INSECT THAT RESTS IN A TREE AND DISAPPEARS BEFORE OUR EYES

In fact, some of them might fairly challenge the leaf insects for the right to be considered the best actors in Nature. Think of a great insect thirteen inches long—three inches longer than this page—resting on a shrub within a few inches of our eyes and being invisible, though fully exposed to view. There is the insect, right before us, but we

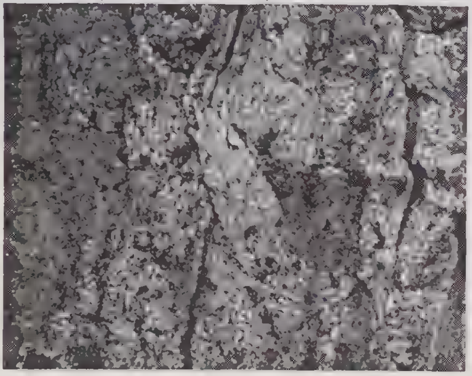
MOTHS HIDING FROM THEIR FOES



Moths are mostly creatures of the night, but when they appear in daylight they escape from enemies by their resemblance to their surroundings. This shark moth is very like the wooden post on which it rests.

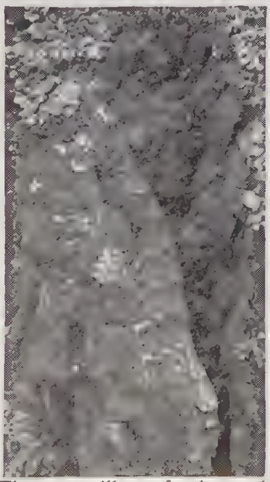


The small engrailed moth, shown in this picture, is grey and brown, mottled with darker shades, and as it rests on an oak post it looks exactly like a patch of lichen, or other natural discoloration of the wood.



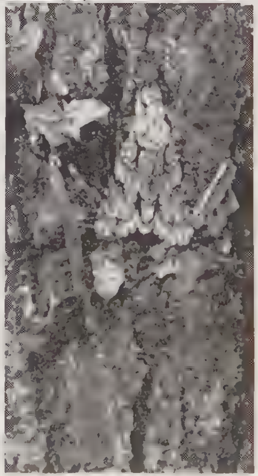
The grey shoulder-knot moth, first appears in autumn. It is pale grey with black markings, and its colors so harmonise with the trunk of the oak on which it rests that it is seen only by close scrutiny.

The marvel du jour moth is bright green and white, with black markings; but it passes unnoticed by its enemies, because it rests upon bright green lichen on tree-trunks, with which its gay colors harmonise.



The caterpillar of the red underwing moth is so like the trunk of the poplar on which it lives that it is found by touch more often than by sight.

The red underwing moth itself is also well protected, for though large and handsome when the wings are expanded, its upper wings, that show when at rest, exactly resemble a tree-trunk or discolored masonry.



The dark dagger moth, that is very like the grey dagger, is hard to find, because of its resemblance to its surroundings when at rest.

The photographs on these pages are by H. Irving, A. E. Tonge, and Percy Collins.

peer and turn about to discover it, and peer in vain. A gentleman who had a couple of these insects alive took some friends to see them. He took them close to a tree. "There they are," he said, "they are both there," and he nodded his head in the direction of the tree. The friends stared until their eyes ached, then turned to him with a smile, thinking that he was playing a trick on them. "I assure you that they are there, right before your eyes," he said.

THE WONDER OF THE STICK INSECTS THAT ARE SEEN AND YET UNSEEN

They gave it up, and though they were close up to the tree, he had to point with his finger to the insects before the untrained eyes of his friends could discover them. Once he had touched them the stick insects were plainly visible. But how wonderful that people who had gone out solely to see them, and had stood close to them, should be unable to tell them from the twigs of the tree! So it was, and so Nature intended that it should be.

Of course, if the insects were flying, they would be readily seen. Not all of the species have wings, but some have two pairs of wings, a small pair in front and a larger pair at the rear. But here we have cause for more wonder. When the wings are open, it is found that the hinder pair have half their surface brightly colored, while the other half is quite plain. The extended wings, so gay and handsome, are easy to be seen. But the insect comes to rest as we watch, and, lo! there is nothing to be seen. We see twigs and stems, but no insect. Where is the brightly colored insect which we saw flying a moment ago? The explanation is that the smaller pair of wings is folded down over the front part of the hinder wings, and looks just like the rest of the body. The second pair of wings, however, shows no color; they cannot be distinguished from the rest of the body.

A MARVELOUS TRANSFORMATION SCENE IN AN INSECT'S LIFE

Now we understand why half the lower wings are colored and half plain. The colored part is folded up and covered by the half which is plain, and now not the sharpest eye could detect the presence of wings at all. Instead of a gorgeous, winged insect which we saw a moment ago, we see what looks like a little branch of the shrub or tree. The whole body is long, slender, and round, and colored like the wood of the tree. But the insect has long legs; how is it to dispose of these? The legs help to deceive, instead of betraying their owner. They are themselves shaped like twigs, and as we look at the insect we fancy that the body is a stoutish stem and the legs are merely thinner twigs branching out in different directions from an older stem.

So long as it remains still, the insect is not to be seen. When it moves, it is so remarkable in appearance that it well deserves its title of the "walking stick." Its home is on shrubs, or among undergrowth, or on the stems of tall grass. It rests by day and seeks its food by night, hence its life is probably as safe as that of anything in the insect world.

These two insects, being naturally sluggish in character, may be said to be specially favored in their struggle for existence. The less they wander about, the less they are likely to be seen and caught. But there are other insects whose lives depend upon their getting about the world. They must find food for themselves, and they must find a suitable place in which to lay their eggs, or their race would perish.

HOW NATURE PROTECTS THE LIVES OF BUTTERFLIES AND MOTHS

The means of protection in their case is just as effective. We find this specially so in the case of moths and butterflies. We have studied this subject already, but as we have a picture of the famous leaf butterfly, we may refer to the matter again. Here is a beautiful butterfly which, when it is flying, is handsome as can be. But when it settles to rest on a tree, not the keenest human eye would readily find it. It raises its wings and brings them together, and there we have what appears one of the ordinary leaves of the tree. Its relative, the dead-leaf butterfly, chooses resting-places where its appearance suggests that it is a leaf which has died.

Luckily, we have not to go to India, or even to a zoo, for these remarkable sights; we may find a splendid example in the common lappet moth. The moths fold their wings differently from the butterflies, not up, but flat down on the back. Now, this means a serious difference in the scheme of protection for the

two. The butterfly, as he shows the under-side of his wings when at rest, must have that side soberly colored, and the gaudy hues all on top. The moth, on the other hand, showing the upper side of the wings when at rest, must be colored underneath, not on the upper surface, or, when he settled down to rest, his life would not be worth ten minutes' purchase, as we say.

The lappet moth is not content to be merely soberly colored on top of his wings; he is so formed that when he rests he looks exactly like a little cluster of dead leaves. Then we must not forget that there are moths and butterflies that resemble wasps and bees, so that, avoided by insect-eating creatures which fear the sting of the wasp and the bee, they escape destruction by their deceit.

INSECTS THAT LOOK LIKE THORNS AND BEETLES THAT LOOK LIKE MOSS

On page 3447 is a picture of a Brazilian insect, which, living among trees bearing thorns, looks so marvelously like a thorn itself, that, though our photograph is taken at short range, we should hardly be able to tell the insect from the true thorn unless it were marked for us on the picture. Mosses and lichens serve as homes for many insects, as well as for coverings for the homes of clever birds which use moss and lichen to adorn and hide their nests. In the East Indies they have beetles which are colored exactly like moss; and there is another creature, like a stick insect, called the moss insect, which looks exactly like a branching twig of some plant over which moss has grown.

We have been studying how insects are protected by natural coloring and disguise. Somewhere in their family history there must have been, according to this theory, a sort of choice by females of mates whose shape and coloring made them most like their surroundings. The result has been that their successors have become more and more like the leaves, and twigs, and moss, among which they make their dwellings, or more and more like the other insects, and other articles, whose appearance they have insensibly copied. The same sort of thing is constantly going on to-day. The insects that are best protected in this way are the insects that have the best chance of escaping hungry enemies, and so of rearing families of their own. The creatures that imitate other creatures have just the same sense of security from their disguise.

LIVING THINGS THAT ARE NOT WHAT THEY SEEM

The moths and butterflies that most nearly imitate things having an unpleasant taste, and are not likely to be eaten, are therefore the most daring of their family. They fly, without haste and without care, in the sunlight, or in the light of evening, where insect-eating birds abound. They know that they need not fear, because by their appearance they are deceiving their enemies into believing that they are not good for food. The butterflies and moths are not the only forms of animal life to do this, of course. There is a winged bug which goes about disguised as a hornet; there is a caterpillar which pretends to be a stick; there is a timid little oriole which has managed to make itself like the powerful friar-bird, and so escapes. The cuckoo wears something the look of the fierce sparrow-hawk, and by its formidable appearance is able to frighten from their nests the little birds among whose eggs the cuckoo determines to place her own.

Few of us would, at first thought, suspect the frog of protection of this sort. We know that our toads and frogs in this country, if they rest still in their abiding place, are very hard to distinguish from their surroundings; but we know also that they are bound to hide and to mask themselves in this manner lest they should be gobbled up by ducks, or other birds, that like frogs and toads. But there is one bold little frog in San Domingo that does not hide.

A LITTLE FROG WITH A RED COAT THAT IS AFRAID OF NOTHING

Among frogs colored like dead leaves and green leaves, or resembling clods of earth, this daring little frog hops about among the enemies of frogs, as comfortably as if he were lord of the whole scene. The others dare not move by daylight, but this one, colored as gaily as vivid red and blue can make him, hops about in the broad daylight. A naturalist, who was puzzled by this, caught some and took them home, and gave them to his poultry. The birds,

though they liked ordinary frogs, would not touch these scarlet-coated creatures. At last, however, by throwing down meat, for which the birds eagerly scrambled, the gentleman managed to get a duck to snatch up one of the frogs. But in an instant the duck dropped it, and ran about shaking its head as if something horrible had entered its mouth. That is why that bold little frog goes out by daylight, fearless of birds and snakes and all the other enemies of frogs—it tastes too bad to be eaten, and it is therefore afraid of nothing.

This case, like the others, is one in which the protection is afforded by Nature. There are cases, however, where the insect has to take means of protection just as the caddis worm, the crab, and the hermit crab do. There is a little insect that lives on the fig-wort which, when it spins its cocoon and enters the pupa stage, becomes, of course, entirely defenceless, and unable to run away from any enemy which may threaten it. But the wise little creature makes its cocoon so much like the seed of the fig-wort that it escapes detection.

AN INSECT THAT DRESSES IN A DIRTY COAT AND PLAYS THE BOGEY MAN

Even that is not so strange as the tricks of an insect called the *reduvius personatus*. This insect, in its perfect state, has wings; but in its early life it has not. In these early days, then, it is exposed to many perils. What is it to do to escape? It does the strangest thing. It drags itself through the old webs of spiders, covers itself with web and dust, and makes itself a monstrous size and most unpleasant in appearance. It is really the bogey man of insects. In this disguise it is quite secure. When the time comes for it to have wings, and so be safe, it brushes off the covering of dirt and web, and comes forth quite a neat and handsome insect.

But it is not by mimicry alone that insects are protected. Some of them are worse than our spitting friend, the llama—they shoot out acid. The most famous of these marksmen is the bombardier beetle, which, when threatened, squirts from its body a liquid which resembles nitric acid. Not only can it shoot strongly; it can make a report with its shooting like the tiniest of tiny guns. This report, which must sound quite loud to the senses of an attacking insect, is at once taken up by the whole family of bombardiers who may happen to be on the spot at the time, and away they fire, bang! bang! bang! as if the intruder had stumbled upon a whole battery of insect cannons. The bombardier can fire from twelve to twenty shots in succession, and after a rest is ready for another cannonade.

SPIDERS THAT PRETEND TO BE DEAD AND CATERPILLARS THAT THROW OUT POISON

This is a very effective weapon, and it serves the bombardier and other creatures that practise it in the place of the power to feign death. Perhaps the spiders are the finest masters and mistresses of the latter art. They curl up in an instant if threatened, and will rest under the closest examination, looking as dead as a door-nail.

The caterpillar of the puss moth should be handled with extreme care, for it possesses in exceptional degree the power to squirt forth its hateful poison. One day a gentleman who did not heed this fact went to look at some puss moth caterpillars which he had put away in a box with some leaves of the sort that they like. The moment he raised the lid, one of the caterpillars squirted forth a jet of acid which entered the right eye of the gentleman. He felt the most dreadful pain, and had to rush away for a doctor, who told him that the poison was very powerful indeed, and such as seriously to injure the eyeball. The pain lasted for several hours, and not for days after was he able to see properly.

Some caterpillars that cannot squirt acid are armed with hairs that produce an irritating rash upon us if we get them on the face or body. The hairs are the armor of those caterpillars, and serve so well for defence that the cuckoo is practically the only bird which will eat them.

THE PROTECTING CARE OF NATURE OVER ALL HER CHILDREN

Such, then, are some of the ways in which Nature protects the humblest of her children. The same thing happens in the desert as in the tropical forest, in the snows of the Arctic regions, and in the warm seas of the tropics. Everywhere we find the same rule in force for the benefit of wild animal life.

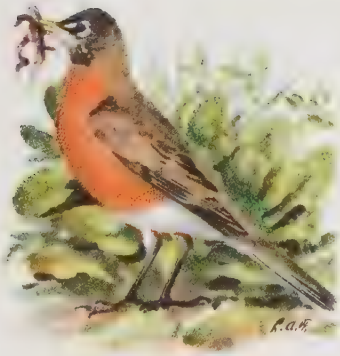
THE NEXT STORIES OF NATURE ARE ON 3523.

SOME COMMON BIRDS OF THE FARM AND THE WOOD

YELLOW-BILLED CUCKOO

LOGGERHEAD SHRIKE

BLUEBIRD



ROBIN

BARN SWALLOW

All of these birds are found both in the United States and Canada. In fact the birds of Canada and of the United States are nearly the same. Arctic birds do not come down into the United States and some tropical birds do not go to Canada. The robin, the bluebird and the barn swallow are common in both countries. The cuckoo winters in the South and the cruel shrikes are the dread of the smaller birds. It sticks its prey upon a thorn and tears it apart.

WHAT THIS STORY TELLS US

IN this story we read about some more of the feathered inhabitants of our Canadian fields and woods. Nearly all the birds spoken of here are song birds, and each one does its little best to help in the chorus of joyous song that fills our woods and gardens with sweet sounds throughout the spring and early summer. The birds are so well described, that we may easily learn to distinguish the birds and their songs and have the pleasure of knowing the names and the habits of the birds that nest in our orchard trees, down in the "bush," or in the fence corner of the meadow by the lane. The colored plates in this article are printed by special permission of the United States Department of Agriculture, Washington, D. C., for which the birds were drawn.

COMMON LAND BIRDS OF CANADA. II

CONTINUED FROM 3156

THE GORGEOUS ORIOLES

The Orioles and the Meadowlarks are relatives of the Blackbirds, but differ markedly in habits. In walking through grassy fields, meadows or marshes, we sometimes flush rather large, brownish birds which, alternately flapping and sailing, fly away. The white outer tail-feathers show plainly, whether the bird is flying or nervously flirting its tail after it has alighted on a tree or fence. The upper parts are dark in color; a line from the bill over the eye is yellow; a black crescent spans the breast; the throat, breast and upper belly are bright yellow, and the sides and lower belly are whitish, spotted or streaked with black. On the ground it builds its nest, and lays four to six white eggs, which are about one inch long, and spotted and speckled with brown. The song of the Meadowlark is a clear, plaintive whistle.

The Baltimore Oriole, sometimes called Golden Robin, is loved by all. In his beautiful plumage of orange and black, he reminds us of stories of the gorgeous plumage of tropical birds, and seems out of place among the more soberly clad inhabitants of northern climes. The head, neck, throat and upper back are black, and the breast, belly and lower back are a rich reddish-orange. It breeds in Eastern North America, and winters in Central America.

The nest of the Baltimore Oriole is most interesting. It is made of grasses, plant fibres, hair, strings and bark firmly interwoven, and is hung between two twigs from near the extremity of a limb twenty to forty feet high. The construction work is done by the female, who, though not so brightly plumaged, is a more highly skilled weaver than the male. The young birds cry ceaselessly for food—a monotonous dee—dee—dee—dee, until one of the parents arrives and stops their mouths. This bird is one of the greatest destroyers of hairy caterpillars, and for this reason is one of the best friends of the orchardist and the forester. The tussock, gipsy, browntail, tent and forest caterpillars, and the fall web worm are all greedily devoured by this species. For variety, curculios, wasps, bugs, plant lice, scale insects, and flies are eaten, while cultivated fruit is occasionally eaten as a relish.

The Orchard Oriole is not so brightly colored. The head, neck and upper parts are black; the breast, belly and lower back are chestnut. This bird dresses quietly, but with excellent taste; his nest is of choicest materials; and the song, which no words can describe, is a finished effort.

THE GENTLE CUCKOOS

Cuckoos are not common in Canada. The Yellow-billed Cuckoo occasionally

breeds here. It is a long, slim, dove-like bird, with upper parts brownish-gray, with a greenish gloss, under parts dull whitish, outer tail-feathers black tipped with white, and the lower mandible yellow. It is distinguished from the more common, northern species, the Black-billed Cuckoo, by its yellow lower mandible, reddish wing-feathers, and black, white-tipped tail-feathers, which marks are absent in the latter. The two species are alike in habits. They are insect-eating birds, and are particularly fond of tent caterpillar larvæ. Cuckoos are of quiet and retiring habits, and on account of their mournful notes, are often regarded with awe by the superstitious. Their short, rounded wings, and long, broad tails give them a silent, gliding flight. The nests are flat, shabby platforms of twigs placed on the lower branches of trees. The eggs are greenish-blue, and over one inch long. They arrive in May or June, and leave in September for Northern South America.

ANOTHER FEATHERED FISHERMAN

The Belted Kingfisher is found about ponds, lakes and rivers, looking for small fish, which he catches by diving. The upper parts are bluish-gray; the tail-feathers have numerous spots and broken bands of white; the throat, a spot before the eye, and the breast and belly are white; a band across the breast and the sides is bluish-gray, sometimes tinged with rufous. The nest is built at the end of a two or three foot tunnel in a sand bank, where five or more glossy white eggs are laid upon the sand. Silently the kingfisher perches on some limb overhanging the water, ever watching for a fish, his only food. Just as you reach the danger line, he drops from his perch, and with a loud, rattling call flies on ahead.

In size and colors, the Blue Jay resembles the kingfisher, but his habits are quite different. Nearly three-fourths of the food of the Blue Jay is vegetable matter, seeds, nuts and fruits. One of his many faults is that of eating the eggs and young of other birds. The head of the Blue Jay is crested; the upper parts are grayish-blue, marked with black and white; a black band passes across the neck, back of the head and across the breast; the tail is blue, with feathers barred with black and tipped with white. He is a mimic and a ventriloquist, and delights in teasing other birds. The nest is built in the crotch of a tree. The four to six pale olive-green eggs, thickly marked with brown, are an inch long.

The Canada Jay, named Whisky-Jack and Moose-bird by lumbermen, is common in northern woods. The fore part of the head is white, the back of the head and nape sooty-black, the back gray, the wings and tail gray, the throat and sides of the neck white, and the under parts ashy-gray. Because of his puffy, gray feathers, and general colors, he resembles a big chickadee. The Canada Jay is not so shy as most birds, and soon becomes a pet about lumber camps, where he feeds on the food thrown out to him. Lumbermen claim that he is very fond of whisky, and they delight in making him " drunk." They nest early in March, while deep snow still covers the ground, and frost reigns supreme in the woods.

TWO BIRDS OF THE NIGHT

The Whip-poor-will is an interesting bird, often heard in the calm of the evening repeating his name, but not often seen. His colors resemble those of the bark of a tree, black, brown and buff, with touches of white. There is a narrow, white band across the breast, and the end half of the three outer tail-feathers is white. These birds breed in Eastern North America, and winter in Florida. Two dull white eggs, with delicate, obscure lilac markings and a few brownish spots, are laid on the ground among leaves. They are birds of the night, and capture and devour numbers of the large-bodied moths that fly in the woods.

Whip-poor-wills are often confounded with the Nighthawk, but are easily distinguished by the long bristles from the base of the bill, the black chin and the rounded tail. In the male Nighthawk, the throat is white and there is a white band across the tail. The forked tail and the white band across the wing readily distinguish it at a distance. These birds lay two mottled gray and white eggs on the ground among rocks in pastures. The Nighthawk passes the day perched lengthwise on a limb; but soon after sunset he mounts high in the air, flies erratically about, at irregular intervals utters a loud nasal " peent," and follows it by two or three unusually

quick, flitting wing-beats. He is coursing for insects, his principal food.

THE RUBY-THROATED HUMMING-BIRD

The Ruby-throated Humming-bird is the only one of the family with courage to leave warm, sunny, southern regions and visit northern countries. It is very small, scarcely four inches long, with upper parts bright, shining green, under parts dusky washed with green, and throat beautiful metallic ruby-red.

The Ruby-throat needs no song. Its beauty gives it distinction, and its wings make music. It seems ever on the wing, now hovering over a bright blossom for a moment, and thrusting its long bill into the flower for honey or for insects, then flying away so swiftly that its wings are lost in hazy circles. The nest is of down, covered externally with lichens, and firmly wound with almost invisible plant fibres. The tiny nest, not much over one inch broad, is placed on a limb high above the ground. In it are laid two tiny white eggs about the size of a pea. Humming-birds are curious and fearless. They will probe a flower held in one's hand, or fly into houses and feed upon sugar placed on a table. Their food consists largely of minute insects.

> "Voyager on golden air,
> Type of all that's fleet and fair,
> Incarnate gem,
> Live diadem,
> Bird-beam of the summer day,—
> Whither on your sunny way?"

THE KINGBIRD—TYRANT OF THE WOODS

The Kingbird is every inch a king. Concealed under the feathers on the head is his crown of orange-red. He dearly loves a fight; and his scientific name, Tyrannus tyrannus, recalls the lives of kings of other days. The upper parts are grayish-slate color, the tail black tipped with white, and the under parts white. The nest of grasses and moss, firmly compacted, is placed high up at the end of a branch. The eggs are one inch long, three to five, and white spotted with umber in color. The Kingbird has no love for crows, black-birds, hawks and jays in particular, and should any of these approach his nest, they are reminded that other birds have rights which they must respect. He captures a vast number of mature insects, and thus renders a great service to the farmer.

The Phoebe is another flycatcher, and has all the food traits of the family, is not too aggressive, and does no injury in any way. They nest in and about dwellings and under bridges. If unmolested, they will return year after year to the same nest. The colors of the upper parts are grayish-brown with an olive-green cast; the crown is greenish-brown; the outer tail-feathers whitish, and the under parts white washed with yellow, and tinged with brownish-gray on the sides. The bill is black. The Phoebe is a devoted parent, and is seldom found far from home. There is something familiar, trustful and home-like in his ways. Perched on a bridge-rail or barnyard gate, he contentedly sings his humble, monotonous "pewit phoebe, pewit phoebe."

OTHER FEATHERED INSECT EATERS

The Wood Pewee is a near relative of the Phoebe, and, like it, has gentle, pensive ways, voiced by his sad, sweet call. All day long he repeats his name "pee-a-wee;" and these clear, sympathetic notes come from the canopy of green overhead during the peace and stillness of the hot midday hour, when summer heat has silenced more vigorous birds. The upper parts are very dark, the wings and tail greenish-brown, and the under parts whitish, washed with gray on the sides. He winters in Central America, and breeds throughout North America, building a nest of grasses and moss high up in a tree. One writer says: "I have seen one Wood Pewee catch and feed to its young forty-one insects in forty-five minutes."

There are several other members of the Flycatcher family. Of these, the Least Flycatcher or Chebec is the smallest and the most common in Canada. Its small size, the comparative absence of yellow on the under parts, and the generally horn-colored or brown lower mandible are the chief distinguishing characters. He salutes you with a business-like "chebec," "chebec," as he sallies after insects about lawns and orchards, which he prefers to the forest. The nest, built in a tree, contains three to five unmarked, white eggs. The Crested Flycatcher is much larger, and has a sulphur-yellow belly, and throat and breast of pearl-gray. His note is a

loud whistle, which pierces far through the clearing, as, full of life and vigor in bright spring days, he flies about in green tree-tops, chattering to himself or calling loudly as he goes.

Only one representative of the Lark family, the Horned Lark, is found in Canada, and it is a winter visitor from northern regions. These hardy birds visit us in flocks, and may be seen running over the snow or barren ground when few birds are about. They take wing with a sharp, whistled note. The forehead, a line over the eye, the ear region, and the throat are sulphur-yellow; the upper parts are grayish-brown; a black patch crosses the breast; the under parts are whitish, and on each side of the head there rises a tuft of elongated feathers resembling a horn. It is from this tuft that the bird takes its name.

THE GROSBEAKS

The Pine Grosbeak is another winter visitor from colder, northern regions. The male is slaty-gray, more or less strongly washed with rose-red. In the female, olive-yellow takes the place of the rose-red in the male. Because of a general resemblance to the American Robin, it is often called the Winter Robin. Its tail is forked, and the beak short and thick. It is very fond of the red berries of sumac and mountain ash trees, which provide it with a nourishing diet. The Evening Grosbeak, which has a black crown, wings and tail, and a yellow forehead, rump and belly, is a hardy and distinguished inhabitant of far northern regions, which comes south to Manitoba and Ontario in winter-time. It builds its nest in the north.

The Purple Finch is much smaller. The male has the entire body suffused with rose-red; but the female bears a decided resemblance to a sparrow, except for the rounded bill, the tufts of feathers over the nostrils, and the forked tail. The Purple Finch is a garden bird, very fond of fruit, blossoms and buds. Its full song is a sweet-toned, carelessly-flowing warble which bursts forth as if from a happy heart, particularly when he wishes to attract the attention and win the love of a demure female. It nests in conifers, and lays four to six blue eggs, which are spotted with brown about the larger end.

BIRDS OF THE SNOW

The little Red Poll, with his bright red crown, grayish-brown back and pinkish breast, is one best known as a winter visitor. It comes from the north in flocks in search of food. It is affectionate and confiding, easily tamed, and makes an interesting pet.

The Snowbunting, or Snowflake, comes south, when the chill season comes on in icy regions, in great flocks, and forages about barnyards and bare fields. They must find enough to eat, because they are always very fat and in good health and spirits. The whole head, neck, rump and under parts are white, with some black on the wings and tail. As long as the snow lasts the Snowflakes stay; but when warm, sunny days in spring arrive, they betake themselves to far northern regions and there build their nests and bring up their little families.

Another bird of the north is the Pine Siskin, which comes south in winter. The upper parts are streaked with black and buff; the wings and tail are greenish-brown with yellow markings, which serve to distinguish it.

Few birds are held in such high esteem as the American Goldfinch or Thistle-bird, a summer resident wintering in the United States and the warmer parts of Canada. The adult male is bright yellow, with black cap, wings and tail. The female is olive-green all over. As they bound through the air in undulating paths, their joyous nature is expressed by the canary-like song which speaks of the wilds of nature and of a happy life. They are seed-eating birds, and may often be seen swinging from the ripened heads of a dandelion or a thistle, as they eat the tufted seeds.

The nest of grass and moss, thickly lined with down, is placed in a bush or tree, and contains three to six pale bluish-white eggs, not much over one-half inch long. When the young birds are placed in a cage, hung from the tree at first, and moved a few feet each day toward the house, the parent birds will feed them until they are old enough to eat the food given canaries. They do well in captivity, the male in spring putting on his coat of yellow and black, and singing his joyous song. The writer kept one for eleven years. It died evidently of old age.

COMMON LAND BIRDS OF CANADA

The wood thrush is larger than the other thrushes and has a bright coat. He has a sweet song.

The catbird, one of the friendliest of birds, makes its nest in hedges and thickets. His song is varied.

The purple finch, a garden bird, charms us with a sweet warble.

The blue jay has a crested head, and blue and white dress, with black bars.

The female of the red-winged blackbird wears a brown dress.

The meadow lark, a rather large bird, lives in grassy fields, meadows and marshes, where its clear whistle is often heard.

The orchard oriole wears a sober dress of black and chestnut.

FINCHES AND SPARROWS

The Finches and the Sparrows constitute the largest family of North American birds, represented in Canada by over thirty species. The sparrows, commonly called "gray birds," are common about roadsides and the farm during the summer months. In general, they build on or near the ground, and are brown in coloring. Their food consists chiefly of insects during the summer, and seeds in autumn. Since the young are fed on insects, and as there are two or three broods each season, this means a vast number of insects taken from crops. When the breeding season is over, sparrows gather into flocks, and may be found in large numbers in weed patches left about the farm. As winter comes on, they leave for the south. Many species take high rank as songsters.

The Chipping Sparrow is the smallest—so small that sometimes it hangs itself accidentally with a horse hair used in lining its nest. The top of the head is reddish-brown, the under parts nearly white, and the bill black. It is the humblest, most unassuming member of the family, making its nest in the vines about our porches, and feeding on the crumbs about our doorstep. Its song is a monotonous "chippy," often repeated. The Winter Chippy or Tree Sparrow is larger, and, in addition to the size, is distinguished by an indistinct black spot on the centre of the breast. They come in flocks from the north when fields are beginning to look brown and dreary, and feed on the seeds of weeds and grasses. In spring, they begin to sing a low, sweet, canary-like song.

The Song Sparrow, already referred to, is one of the best singers of early spring, and tells us that the winter is past. He strikes three or four strong notes, and then runs down the scale.

> "A joyful flourish lilted clear—
> Four notes—then fails the frolic song,
> And memories of a vanished year
> The wistful cadences prolong;
> 'A vanished year—O, heart too sore—
> I cannot sing:' thus ends the lay:
> Long silence, then awakes once more
> His song ecstatic of the May."

The crown is brownish, and the breast is marked with wedge-shaped marks of black and brown, which tend to form a larger blotch at the centre. Its vivacious song may be heard by night as well as by day, and in all weathers; and though not a sociable species, it is one of the best known of all sparrows. It nests on the ground or in bushes, and lays four to five white or bluish-white eggs with brown markings. The Vesper Sparrow much resembles the Song Sparrow, but is distinguished by two outer white tail-feathers which show when it flies. It is a spring migrant, wintering on the Atlantic coast and breeding in Canada. Walking along a country road, the Vesper Sparrow will run rapidly ahead of you, wait for you to catch up, then run ahead again. His song is clear, loud and ringing.

The Savanna Sparrow has no distinctive marks except pale yellow marks over or before the eye and on the bend of the wing. It is a common bird by roadsides and in fields, and chips vigorously at every passer-by as it bobs up and down on fence posts. Its song is a weak, musical trill most audible toward sunset. Swamp Sparrows are distinguished by their unstreaked breasts and different song, a simple, sweet, monotonous "tweet-tweet-tweet," repeated many times. They are rarely seen beyond the confines of a wet meadow or grassy marsh.

In early spring, the Fox Sparrow, which is foxy-red all over, and larger than the other species, is seen about damp thickets and roadside shrubbery foraging among the dead leaves. Its song is not surpassed by that of any of the sparrows. One may be sauntering along wooded fields, enjoying the balmy air of evening, when he is halted by a beautiful new song. It is a solo at first—an emotional outburst rising full toned and clear, and passing all too quickly to a closing cadence which seems to linger in the silent evening air. Then, of a sudden, the solo is succeeded by a chorus. From every side, and from a hundred throats, comes the same sweet melody—the song of the Fox Sparrow.

"OLD TOM PEABODY"

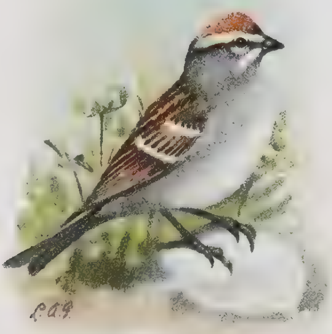
The White-throated Sparrow, or Old Tom Peabody, is the national song bird of Canada, because he plainly says: "I love dear Canada, Canada, Canada."

> "Shy bird of the silver arrows of song
> That cleave our northern air so clear,

INTERESTING BIRDS OF NIGHT AND DAY

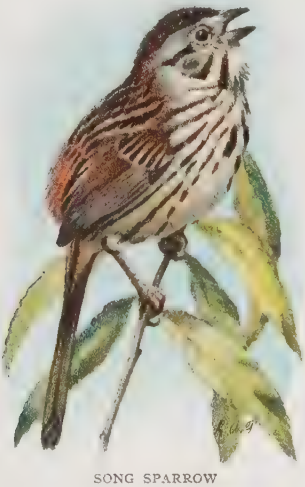
KINGBIRD

NIGHTHAWK



CHIPPING SPARROW

BROWN THRASHER



SONG SPARROW

Some of the sparrows are sweet singers, destroy many injurious seeds and insects, and have beautiful manners. They are not like the rude English sparrow, which has become a nuisance since it was introduced. The chipping sparrow and the song sparrow range over the greater part of North America. There are many other kinds of sparrows. The brown thrasher is a delightful songster, while the kingbird is a sturdy fighter for his rights. The nighthawk eats many insects.

Thy notes prolong, prolong,
I listen, I hear—
'I — love — dear — Canada — Canada — Canada.'

"Shy bird of the silver arrows of song,
Shy poet of Canada dear,
Thy notes prolong, prolong,
We listen, we hear—
'I — love — dear — Canada — Canada — Canada.'"

The centre of the crown has a white stripe, bordered on each side by much wider black stripes, and a white stripe passes from the eye backward along the side of the head. The throat is marked by a square, white patch. There is little in their modest appearance to tell one, as they feed on the ground near their haunts, of their vocal powers; but suddenly a clear, sweet, plaintive song arrests one's attention, and we listen to the patriotic words of Canada's national song bird.

We must not leave the Sparrow family without referring to a common bird, slate-color above, white below, flesh-color bill, and white outer tail-feathers. It is the Junco, a welcome bird of early spring days, even though dressed in sober colors, and with a song seldom heard. The "tsip" of the Junco is known to all, but few have heard his low, sweet song, which is as unpretentious and cheery as the bird itself.

THE WOODLAND FLAME

The Bird of Paradise in our northern regions is the Scarlet Tanager. The male is bright scarlet, with black wings and tail. Unfortunately, it is not common in Canada, but occasionally breeds in the warmer sections. Its song is a loud, cheery carol, suggesting the song of the Robin. These beautiful birds are found in open woods, parks or orchards. They live on seeds, berries and insects.

SWALLOWS OF BARN, BANK AND WOOD

The Swallows are denizens of the air. It is their domain, and it contains their food. In structure, they are especially adapted for their life, having long wings, small feet, and short, broad, deeply-cleft bills fitted for catching insects. They are highly insectivorous, and are, therefore, of great benefit to man.

The Barn Swallow has upper parts of dark blue, forehead, throat and upper breast chestnut, lower breast and belly buff, and a deeply forked tail, showing white markings when spread. It builds a nest of mud and grass, lined with grasses and feathers, and fastens it on the rafter or beam of a barn or other building. The eggs are white, with numerous brownish spots. Barn Swallows rank first among a family of birds famous for their power of flight. In search for insects, they skim low over the fields, turn quickly to right or left, up or down, and pursue their marvelous course with ease and grace.

The Bank Swallow has brownish-gray upper parts, a white throat, and a brownish-gray band on the breast. It builds a nest of grasses and feathers in a hole in a sand bank two or three feet from the entrance. It may be generally known from other swallows by the small size, absence of metallic covering, and the nesting habits. The Cliff or Eave Swallow has a whitish forehead, steel-blue crown and back, chestnut throat and sides of head, brownish-gray breast, and greenish-brown tail-feathers of nearly equal length. Its nest is of mud, pocket-shaped, with an opening at one side above, and fastened beneath a cliff or the eaves of a barn. The birds will return year after year to their rows of mud tenements.

The Tree Swallow has upper parts of steel-green or steel-blue, under parts of white, and the tail slightly notched. They build nests of grasses and feathers in the hollow of a tree, or they may accept as substitutes for the tree the boxes erected by man. The best known of the swallows is the Purple Martin, which occupies houses or boxes erected for its occupation, if the English Sparrow has not already taken possession of these before the Martin has arrived in late spring. The male is shining blue-black, with wings and tail duller. Martins not only drive away hawks, but they eat many injurious insects, beetles, in particular, for which they have a great fondness.

The Chimney Swift closely resembles the swallows in its habits, except that it never alights on the ground, even to obtain the materials for its curiously constructed nest placed on the inside wall of a chimney. The birds are smoke-colored; and spines on the end of each tail-feather enable them to hang to the

upright walls of the soot-lined chimney. The nest is made of twigs glued to each other and to the side of the chimney by the bird's saliva. The three to five white eggs are long and narrow. Throughout the day numbers of swifts are scouring the air for their fare of insects; but as night approaches, they return to the chimney, where there is a continuous and not unmusical twittering day and night.

The most polite and the best groomed of all birds is the Cedar Waxwing, often called Cedar-bird or Cherry-bird. The forehead, chin, and a line through the eye are velvety black; the head, and the upper parts are a rich grayish-brown, with small, red sealing-wax tips on some of the wing-feathers; the belly is yellowish, and the tail has a yellow band at its end. The nest is placed in a fruit or shade tree, and the eggs are bluish-gray, spotted with umber. The Cedar Waxwing is a common summer resident. Though very beautiful, and an insect destroyer to a certain extent, it undoubtedly consumes a large number of cherries and currants and a few raspberries. They are very tame, and allow any one to almost touch them while they are feeding. The note is an insignificant hiss. Their beauty, and their gentle, refined ways, make them seem superior creatures of the air, whom we must respect.

THE BLOODTHIRSTY SHRIKE

The Northern Shrike or Butcher-bird is a hawk-like, bloodthirsty bird, which preys on small birds and impales them on a thorn, a fence barb, or a forked twig—hence the name Butcher-bird. The male is ten inches long, with gray, black and white the prevailing colors. They are unable, because of the structure of their feet, to hold their prey while they eat it, so they impale it upon thorns or barbs and tear it to pieces with their hooked bills. They also feed on mice and noxious insects. The song consists of various whistles. They place their rude, bulky nests of twigs and weeds in thorny trees or shrubs; and lay four to six grayish-white, spotted eggs over an inch long.

The Loggerhead Shrike has black upper parts and white under parts, and his habits are in general like those of the Northern Shrike. His notes are harsh and unmusical.

THE VIREOS

The Vireos are small, insect-eating birds, slow in their movements, and lovers of trees, where they secure their food from crevices in the bark or from the under side of leaves. With us, the most common species is the Red-eyed Vireo, which has a slaty-gray crown, bordered on either side by black, a white line over the eye, under parts pure white, and upper parts olive-green. The conspicuous white line over the eye, with its black border, and the bird's red eye, distinguish it from its relatives. It is a summer resident, wintering in South America. All through the spring and summer months, the warble is heard from woodland and roadside, often becoming monotonous. It is delivered in parts, with intermissions of a few seconds between, from morning until night. He is called the Preacher, because he explains his subject in a few words, and then makes a pause for his hearers to reflect upon it. Translated, his sermon is: "You see it—you know it—do you hear me?—do you believe it?"

The Warbling Vireo is olive-green above, with no black border on the crown. The under parts are white, slightly washed with yellow. It breeds as far north as Hudson Bay, and winters in the tropics. Its song is a firm, rich, continuous warble. The Yellow-throated Vireo has bright olive-green upper parts, a white belly, and eye-ring and throat and breast bright yellow. He is a dweller in tree-tops, and his tune is deeper, richer and more deliberate than that of the Red-eyed. He calls: "See me; I'm here; where are you?"

CATBIRD AND BROWN THRASHER

"From the coverts of the thicket comes a wondrous burst of song;
Tripping gaily, pressing, crowding, flood the liquid notes along!
'Tis the catbird, dear old Orpheus, with a heart as full of joy
As our quaint old Quaker poet, or his whistling bare-foot boy."

The Catbird is one of the most intelligent of birds. As the copses come into leafage in May, Catbirds and Thrashers fill the air with their delightful songs. We close the eyes and give the ears full enjoyment. The Catbird, so-called because he can "mew" like a cat, is in-

clined to be friendly to man, and where he is well treated and his confidence won, will show himself delightfully familiar, coming around the veranda, answering one's talk, and singing for our entertainment. He is a charming singer. The song seems to be made up as he goes along. It is an indescribable medley interspersed with various mews and calls.

His general color is dark gray, with a black cap, and chestnut under the tail coverts; and he is nine inches long. The nest is found in hedges or thickets, and is made of twigs, rootlets and grass, lined with fine black roots. The four eggs are plain greenish-blue. In general, Catbirds are lively, playful, full of pranks and quaint performances, and should be encouraged about our homes.

The Brown Thrasher calls from his lookout: "Shuck it, shuck it; sow it, sow it; plough it, plough it; hoe it, hoe it." His song is a bright, cheerful carol, often long continued, but always clear and sweet. Above he is bright reddish-brown; below, white with black spots; and the length is about one foot. He is an inhabitant of shrubbery and borders of woods, where he passes much time on the ground, scratching among the fallen leaves. He is active, shy, and suspicious, and does not like to be watched. The Brown Thrasher is a finished musician, with rich tones and exact execution. Morning and evening, mounted on the upper branches of a tree, he pours forth his song in a way which makes it appeal to the heart and to the mind.

THE FRIENDLY WRENS

The Wrens belong to the Thrasher family, but are diminutive in size. The House Wren breeds in southern Canada. It is brownish above, with tail and wings barred, dull gray below, and barred on the flanks with brown. They are bold, sociable, confiding little birds, building their nests in bird-boxes erected for them. They feed wholly on insects, and are, therefore, beneficial. The song is loud and clear and bubbles with enthusiasm.

The Winter Wren breeds in northern Canada and winters southward. It is bright cinnamon above, paler below, with sides, wings, and tail heavily barred with black. This is the shortest and most stoutly built of wrens, and looks very pert with his stubby tail erect over the back. They nest in brush heaps, tin cans, or in hollow stumps. The nest is lined with feathers, and the little eggs are white, sparingly speckled with reddish-brown.

The Kinglets are our smallest birds. Though very small they are active, hardy little birds, and always seem to be happy. The Golden-crowned Kinglet has the centre of the crown bright, reddish-orange, bordered by yellow and black, with upper parts olive-green and under parts whitish. It builds a tiny, hanging nest of mosses, bark and feathers, high up in a tree, and lays nine or ten tiny eggs. Its song consists of a few weak chips or chirps and trills. The Ruby-crowned Kinglet has a partly concealed crest of bright red. The Kinglets are usually seen flitting about evergreens. They breed in Canada and winter in Mexico.

WOODLAND MUSICIANS

The Thrushes are conceded first rank among song-birds by all true lovers of music. Wilson's Thrush or Veery has the entire upper parts a uniform reddish-brown. Below it is dirty white, with a few faint marks on the breast. It is found in swamps, and in dry woods. The nest is on the ground and made of strips of bark and leaves. The eggs are greenish-blue. They are shy and retiring, and live near the ground. All the wondrous mysteries of the woods find a voice in his song. It is a weird, ringing monotone of blended alto and soprano notes. It has neither break nor pause, nor does it seem to come from any one place. In fact, the bird is a ventriloquist, and has led many a bird-lover a weary tramp in searching for him on different trees while he has not moved from his perch. The song is like the syllables "vee-r-r-hu" repeated eight or nine times around a series of inter-twining circles.

The Wood Thrush is distinguished from other thrushes by its larger size, its brighter cinnamon colors above, and the numerous large, round black spots on its under parts. His song is very clear and flute-like, containing many notes of the scale; and as it rings through the woods like a hymn of praise, it invites one to yield to the ennobling influences of Nature.

The Hermit Thrush has a reddish-brown tail much brighter than the back

and head, and a breast quite heavily spotted with black. When migrating it does not sing; but in its summer home in the woods, where it finds seclusion, it pours forth a song which in purity and sweetness of tone and in exquisite modulation touches the very highest chords of bird music. The Olive-backed Thrush, Bicknell's Thrush, and other species are summer residents in Canada, and are quite similar to those described.

THE AMERICAN ROBIN

The best-known and most-beloved of all the thrushes is the American Robin, which is abundant about farms and dwellings in all parts of Canada. His loud, cheery carol, "cheerily-cheerup, cheerily-cheerup," repeated many times, is welcomed in the early spring, and tells us that the winter is past.

The Robin is about ten inches long, much larger than the little Robin Redbreast of England, which is not a thrush. The male has a black head, a reddish-brown breast, and drab upper parts. The female has duller colors. The nest is of coarse grasses and rootlets, with an inner wall of mud and lining of fine grasses, and may be found in shade trees or on a veranda beam. She lays three to five greenish-blue eggs about one inch long. The young are fed on larvæ, chiefly cut-worms, and in this way Robins do a good work. It is true they may help themselves to cherries and strawberries from the farmer's garden; but otherwise they do little damage, and none would wish to miss their cheery songs.

"The Robin in the cherry tree
Is blithe as any bird can be;
And bubbling from his silver throat,
His wordless songs of rapture float—
O happy, happy May."

The Bluebird is another thrush which makes itself at home in our orchards and gardens, and occupies the cosy bird-house in the apple-tree. "The robin, the forerunner of the spring, the bluebird with his jocund carolling." Twenty years ago the Bluebird was one of the most abundant of our summer residents, but now it is not common. It may be it goes to more northern unsettled districts, where it can still find "snake" fences and stumps in the pastures. It is cobalt-blue above, cinnamon-red below, with a white belly. Its disposition is typical of all that is sweet and amiable, and its song is a sweet warble.

THE WOOD WARBLERS

We close this review of Canadian land birds with a reference to the Wood Warblers, which are found only in America; and of the one hundred species known, about thirty visit Canada. With few exceptions they are inhabitants of the woods, but may be found in the trees of lawns and orchards. They are among the last of the spring arrivals, and the first to leave in autumn. Like the flycatchers, their food is chiefly insects. Some look for these on leaves or bark, while some capture a large part of their food on the wing. All are small. Many are among our brightest colored and most interesting birds. None of them is remarkable as a songster. All through the summer they are actively engaged in exterminating the hosts of our smaller insect enemies, and many thousands of broods of caterpillars are destroyed by them before they are large enough to do mischief.

The Yellow Warbler or Summer Yellowbird is the most familiar of all because of its canary-like plumage, and because it nests in the trees and shrubbery about the home. The upper parts are bright greenish-yellow; the under parts are bright yellow streaked with brown. The female is uniformly yellowish olive-green. Its nest of fine grasses and fibres is lined with down. The tiny eggs are bluish-white, thickly marked with brown. Its bright colors, and its pleasing though simple song, a happy "wee-chee, chee, chee, cher-wee," add to the attractions of the rural home.

One of the commonest and the most interesting of the woodland warblers is the Oven-bird. The crown is orange-brown bordered by black, the upper parts olive-green and the under parts white, with the sides of the throat, breast and sides streaked with black. Flying up from the ground, he cautiously hops from branch to branch, walks carefully along a limb, and then suddenly "bursts forth into a wild outpouring of intricate and melodious song" which vibrates through the woods, as in rising tones it seems to say "teacher, teacher, teacher, teacher."

THE NEXT STORY OF CANADA IS ON PAGE 3731.

READING

THE VERB AND ITS MOODS

CONTINUED FROM 3382

As I write this lesson, I am sitting by the sea, watching many boys and girls digging on the sands and paddling in the water. If I were to say to you, "I have just had a bath," I should be making a statement about something that I have just done. And if I were to ask you, "Have you had a bath?" I should be asking you a simple or direct question. But supposing I gave you an order, and said, "Go and have a bath," I should be no longer merely stating something, but I should be commanding you to go and do something. So, you see, there are at least two different *manners* or *ways* of talking about actions: (1) We can either make simple statements, or ask simple questions about them, as "The cow JUMPED over the moon," "The boy STOOD on the burning deck," "Who KILLED Cock Robin?" (2) We can tell people to go and do them, as "Polly, PUT the kettle on," "Zachariah, BLOW the fire."

Now, another word for *manners* or *ways* is MOODS, and so we call these two different MOODS of the verb. The first is called the IN-DI-CA-TIVE MOOD, because it indicates or points out; and the second is called the IM-PERA-TIVE MOOD, because it is imperial (like an emperor) and gives orders. Here are some more examples of the Imperative Mood:

"Little Boy Blue, COME, BLOW on
your horn."

"If at first you don't
succeed, TRY,
TRY again."

"TELL me the old, old story, (imperative)
For I FORGET so soon." (indicative)

"CHARGE, Chester, CHARGE! On, Stanley, on!" (imperative)
WERE the last words of Marmion. (indicative)

"Pat-a-cake, Pat-a-cake, Baker's man:
BAKE me a cake as fast as you can; (imperative)
STICK it, and PRICK it, and MARK it with B (imperative)
And SEND it home for Baby and me." (imperative)

"BE thou faithful unto death (imperative),
And I WILL GIVE thee a crown of life." (indicative)

Now, do you think you can pick out for yourselves the examples of these two MOODS in the following sentences? Try.

"Suffer little children to come unto Me, and forbid them not, for of such is the Kingdom of Heaven."

"Heap on more wood, the wind is chill."

"Snail, snail, put out your horns,
I'll give you bread and barleycorns."

"Hold the fort, for I am coming."

"Try not the pass, the old man said:
Dark lowers the tempest overhead."

There are 6 imperatives and 6 indicatives in those sentences. Have you found them all?

Here are some lines that may help you to remember these two moods:

If you order a person to bring you
some chalk,
Or tell him to eat up his food;
Or bid him be seated or go for a walk,
You use the Imperative mood.
But when you are telling him what
you have done,
Or asking him what are his views,
Or stating the fact that twice two are
not one,
The Indicative mood you will use.

If you learn these little verses you will find that you will have no difficulty in discovering the moods of any verbs you come across from time to time.

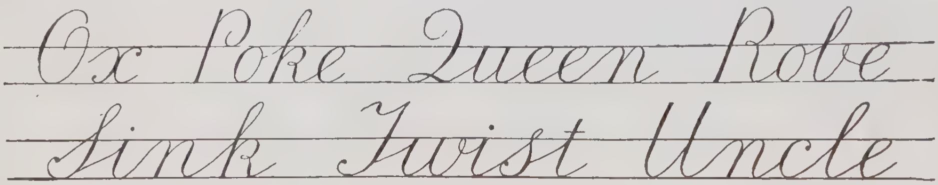
WRITING

A NEW WAY OF WRITING FIGURES

"MOTHER, we wrote words with fourteen capital letters last time," said Nora, when she and Tom next came to their mother for a writing lesson.

"Then there are twelve more," observed Tom. "And we stopped at N, so we begin with O."

"That's right, Tom," said his mother. "Here are the words to be written now:"



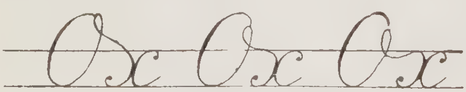
"It doesn't join on, Tom. See!" said his mother, as she wrote "Take."

Meanwhile Nora had been thinking about capital S, and noticing how the pen ran round the lower part of it after making the loop on the up-stroke of the letter.

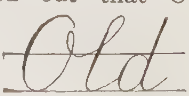
"Q, R, and U join on nicely," said Nora, as she looked at these words. "T can't manage to join any better than the first G, and, mother, don't you think something might be done to help O? The other letters were so kind to it before."

"Suppose we try, Nora," was the reply. "But mind that pen. If you knock it about so, the ink will drop on the tablecloth. It is safer to lay pens down when they are not being used."

Tom wanted to see what he could do for O, and this is what Nora and he managed by making the knot continue into the first part of the letter x:



Their mother pointed out that O joins more easily on to a looped letter like l, in this word "old":

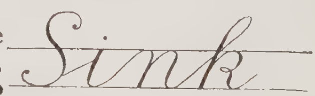


Tom liked what he called T-square T, and asked to have a word beginning with that letter.

"There is another way of making capital S," said her mother. "It is very like printed S, and begins and ends with a dot. Tom will fetch a newspaper from the bookshelf, and we shall be able to see how curly both are."

"What a pretty letter!" exclaimed Nora, who liked the curves and the way the upper and lower parts were balanced. Tom hunted among the printed S's in the newspaper, and showed Nora how much they were like the printed S they were writing.

"It joins on badly, like the other one," said Nora.



"Now there are V, W, X, Y, and Z to write as capital letters," the children's mother said, as she gave them the words to copy which we shall find on the top of the next page.

"V and W are the only capital letters there that do not join," Nora remarked.

"It is possible to join them, but awkward," said her mother. "There are some words, like 'What,' in which

Very Walk Xmas

Yeast Zero

h joins fairly well, but when a vowel follows it, it is clearer to leave the letters unjoined. We must always remember, that directly letters are at all difficult to recognize, the writing is bad. So it is far better not to try to join on certain capital letters until you have thoroughly mastered the use of your pens. X, Y, and Z join on to any letter with ease.

"You have not yet learned to write the Roman numerals, so we will write them now. They are easy because they seem to be formed from capital letters.

"Some of these are the same as letters, though it is unlikely they really come to us from letters. V, for instance, is probably X halved. But it is easy to think of the Roman numerals as letters—one or I, two ones or two I's, three ones or three I's, one before five, five or V, one after five, two after five, three after five, one before ten, ten or X, one after ten, two after ten, and so on till twenty or two X's.

"The numbers between twenty and thirty, or XX and XXX (two tens and three tens), are made by adding the numerals from I to IX. Forty is XL, or ten before fifty, as L stands for fifty. Sixty is ten after fifty, or LX. Seventy is twenty after fifty, or LXX. Eighty is thirty after fifty, or LXXX. Ninety is ten before a hundred, or XC, for one hundred is C (short for Latin *centum*, meaning a hundred). So, you see, I or X before another number means take one or ten from it; after it, add one or ten to it. The Roman numerals take it for granted, that every girl and boy can do subtraction and addition."

I II III IV V VI VII VIII IX X

XI XII XIII XIV XV XVI XVII

XVIII XIX XX XXX XL L LX

LXX LXXX XC C

ARITHMETIC

HOW TO DIVIDE BIG NUMBERS

IN our last lesson we learned how to divide the number 596 by 4. It is quite as simple to divide any other number, even though it be a large number, containing millions or hundreds of millions, by any number from 2 to 12. The multiplication table is all that is required, we shall find.

Divide 5279517 by 9.

```
9 ) 5279517
    -------
     586613
```

Here there are 5 millions, but since that is less than the divisor, 9, it is clear, of course, that we shall not have millions in our answer. But we "carry" the 5, and placing it before the 2, we get 52 (hundred-thousands). Then say:

9 into 52, 5 and 7 over.
9 into 77, 8 and 5 over.
9 into 59, 6 and 5 over.
9 into 55, 6 and 1 over.
9 into 11, 1 and 2 over.
9 into 27, 3.

Divide 43848 by 12.

```
12 ) 43848
     -----
      3654
```

Here, again, there are not enough ten-thousands to give any ten-thousands in the answer, so we have to carry the 4, and get 43 (thousands) before we can begin the division.

Say, 12 into 43, 3 and 7 over.
12 into 78, 6 and 6 over.
12 into 64, 5 and 4 over
12 into 48, 4

We have, of course, noticed by this time that the figure which we carry, the figure which is "over," can never be as big as our divisor. For, in learning what division was, we counted, let us suppose, the tens into each group until there were not enough tens left to make another for each group. That is, the number "over" was always less than the divisor.

When our divisor is greater than 12, the idea used in the division is the same as before, though the process is longer. For this reason, the method we have been learning is called *short* division; while the method for numbers greater than 12 is called *long* division.

Still, there are many numbers greater than 12 for which we can use short division. Suppose, for example, we have a number of things which we wish to arrange in groups which each contain 15 things. We know that there are 5 *threes* in 15. So, if we first arrange the things in groups of *three*, and then form larger groups by taking *five* of the groups of three, it is clear that each of the larger groups will contain five threes—that is, 15.

Divide 229695 by 15.

3) 229695
5) 76565
15313

As explained above, we first divide 229695 by 3. This shows us that 229695 things can be arranged in 76565 groups of three. We next divide 76565 by 5—that is, we form groups which each contain 5 of the groups of three, or 15 of the given things. The division gives us 15313 of these large groups, so that 229695 divided by 15 gives 15313.

In this way we are able to divide by any number which comes in our multiplication table. Thus, to divide by 108, we divide by 9, and then divide the result by 12; because 9 times 12 make 108, so that the first division forms groups of 9, and the second division forms groups which each contain 12 groups of 9, or 108.

In the above example, the two numbers 3 and 5, which when multiplied together make 15, are called *factors* of 15. Similarly 12 and 9 are factors of 108. The process just explained is, therefore, called *division by factors.*

It should be noticed that many numbers have more than one set of factors. Thus, 4 times 9 make 36, and 6 times 6 also make 36. To divide a number by 36 we may use whichever set of factors we like.

In our next lesson we shall learn long division, which has to be used in all cases where the divisor cannot be separated into factors.

EXAMPLES:

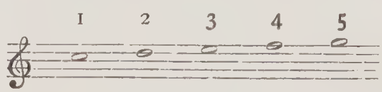
1. Divide 184429 by 7.
2. Divide 2043646 by 11.
3. Divide 816408 by 8.
4. Fifty-nine thousand and forty apples are to be packed in baskets. If each basket holds 72 apples, how many will be required?
5. How many times can 132 be taken away from 2997324?
6. A piece of ground contains 12096 strawberry plants, in 96 rows. How many plants are there in each row?

MUSIC

THE RESTING GAME OF THE FAIRIES

THE fairies have something new to tell us; they say the white notes and the black notes may also be called *keys*: and when we talk of the entire number of black and white keys together, we are to call them the *keyboard.*

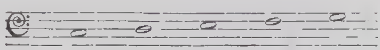
To-day we are to put our right hand on the keys. The fingers are just to rest on the key surface, but *we are not to press the notes down.* Our fingers must be curved, and just separated, so that each one may have a key to itself. We shall have five keys following one another in order, like this:



and we must remember that the fairies want the back of our hand to be quite level.

It is very easy to let the little-finger side of our hand slope downwards; but our fairy friends do not like this

at all; so we must watch very carefully. The first finger (we very often call it the thumb) must be quite free; we must not squeeze it against the hand, and the fingers 2—3—4—5 must rest in the middle of their notes. When we are quite sure that the right hand is properly placed, we must let the left hand take its turn, and play exactly the same game. The fingers must rest on the surface of five white keys:



5 4 3 2 1

but, just as before, *they are not to press the notes down.* Each finger must be separated from the other, so that each one may have a key to itself; the back of the hand must be quite level, the first finger quite free, while fingers 2—3—4—5 must occupy the middle of their notes.

The fairies call this "the resting game," and they like each hand to play it in turn. Of course, while we are only thus resting on the surface of the keyboard, we cannot make the fairies sing; but it means that we are getting ready to make the lovely tone we so want to hear.

You and I want to make the piano sing, and that is why we are taking such trouble with our arms, our hands, and our fingers. We must think of our fingers, our hand, our forearm (that is the part of our arm near the hand), and our upper arm as four tools ready to do the different kinds of work we shall find necessary to make the fairies tell all their secrets. To-day we are learning how to rest, so that fingers and hands may be quite in their proper position, and quite loose—that is, free from any stiffness. The fairies give us one very safe, sure rule: *Whenever we feel stiff, we are wrong,* and it is a rule which we must always remember.

When we are quite sure our hands are resting in their proper position on the keys, we will again play the "fairies' see-saw game." We must keep our fingers just touching their notes, the hand being quite loose, and then, without depressing the key, balance the arm at the wrist, up and down, about an inch each way. This will show us if we are resting properly now our fingers are on the keys. You see, we have four games to play every day, and we must never forget one of them.

1. The sleepy arm.
2. Bending our fingers towards the palm of our hand, and then letting them spring back.
3. The fairies' see-saw.
4. The resting game and the see-saw together.

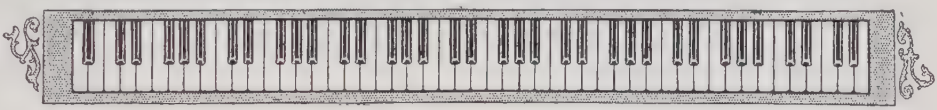
A man came into the world to show us how beautifully the piano fairies could sing. His name was Chopin. He played the piano exquisitely, and he tried to teach other people to do so, too. Nothing made him more unhappy than to hear anyone *hit* the piano, or play at all roughly. He would say, "Is that a dog barking?" He was quite sure that the piano fairies could not make an unmusical sound unless they were approached wrongly, and treated badly. A pupil once told him that she had learned more from listening to singing than anything else. What do you think was his reply?

"That is right, all music ought to be song."

Frederick William Faber, who wrote some of our finest hymns, left us a beautiful idea when he sang about music:

> There are sounds like flakes of snow falling,
> In their silent and eddying rings;
> We tremble, they touch so lightly,
> Like feathers from angels' wings.

We must always remember that we move the notes or keys for one purpose only—*to obtain music.* If we want the fairy songs in all their beauty, we must call forth the lovely tone-pictures they paint for us, by *thinking, listening, and feeling.* We must think what the fairies want us to hear. We must listen for the *beginning* of every sound, to know we have found the right one. We must feel how much we have to do to set the keys moving.

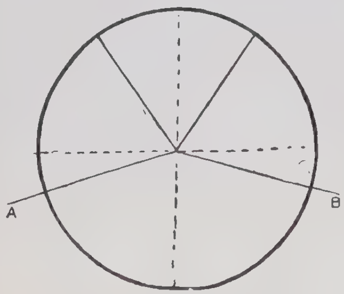


This is the Row of Black and White houses in which the Fairies and the Goblins live. Try to pick out all their places so that you can remember them

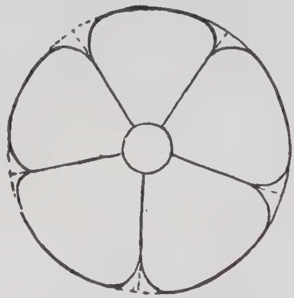
The keyboard of the piano.

MAKING CIRCLES AND FILLING THEM IN

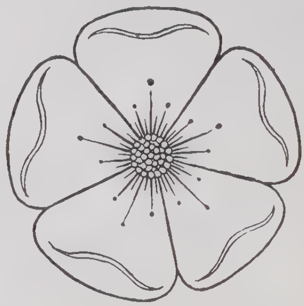
EVERY boy and girl who learns drawing hears sooner or later the story of Giotto's famous O. In Italy the saying "Round as Giotto's O" has become a proverb. Giotto was a famous Italian artist, and when the Pope wanted a certain piece of work done, and sent a message to ask Giotto for some of his work that he might judge if he were clever enough to do it for him, Giotto took a piece of white paper, and with some red paint drew a circle so perfect that everyone marveled, and the Pope needed no further proof of his skill.



1. How to divide a circle for five-petaled flower.



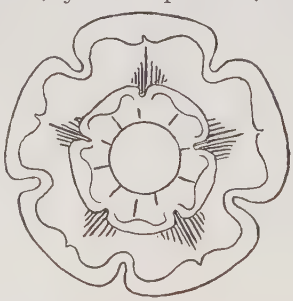
2. Outline of five-petaled flower in a circle.



3. The finished five-petaled flower.

Circles are very, very difficult to draw, worse than straight lines, yet it is more natural for us to draw a curve than a straight line.

Our baby brothers and sisters always make scribbles in the shape of circles if we give them paper and pencil, and if we stand at the blackboard we shall find it easier to draw big sweeping curves than to draw lines.



4. Heraldic, or Tudor rose.

To-day we will practise circles with white chalk on the blackboard or on sheets of brown paper pinned on the wall.

The first curve is the biggest one, drawn from the shoulder, standing at arm's length away from the board. The first half or two-thirds is easy; we draw outwards, not towards the chest at first; then we reverse and come back over the old line till the two ends join. The next curve is drawn from the elbow in the same way, but the circle is smaller, of course; and after practising these till we are satisfied, we will go to the drawing-board again and try these curves with charcoal on white paper, drawing from the elbow—that is, resting the elbow on the table and keeping it there while we draw—and then from the wrist, resting the arm on the table just between the wrist and elbow. The smallest circle is made by resting the hand firmly on the table, drawing from the wrist, and making the curves just as large as the fingers will let us.

When we have made good circles, which we can only do with plenty of practice, we will put in one of them the heraldic rose which came in our last lesson. It is difficult to put a five-petaled flower into a circle with freehand drawing, as all the petals must be the same size. The best way is shown in picture 1 on this page.

The two diameters—that is, the lines dividing the circles into quarters—are drawn as guides very faintly first; then the lines A and B just below the horizontal diameter. Now it is easy to draw in the petals as we see them in picture 2. The division between two petals always comes under the centre of one of the other petals, either the top or the bottom one.

There is a way by which we can divide circles exactly into parts, but this is done with compasses, and to know how to do it we must learn geometrical drawing.

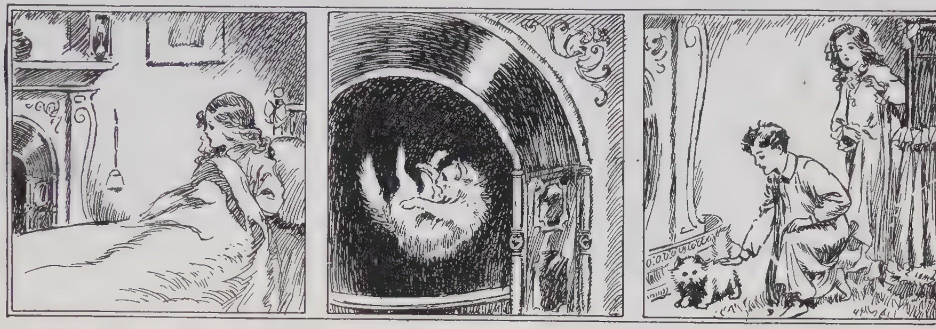
LITTLE PICTURE STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Il est huit heures. La chambre à coucher est noire. Nous sommes presque endormis.
It is eight hours. The room to to sleep is black. We are nearly asleep.
It is eight o'clock. The bedroom is dark. We are almost asleep.

Tout à coup il y a un bruit dans la cheminée. "Qui est là ?" dis-je.
All at blow it there has a noise in the chimney. "Who is there?" say I.
Suddenly there is a noise in the chimney. "Who is that ?" I say.

On ne répond pas. La bonne entre ; elle frotte une allumette et allume le gaz.
One (not) responds not. The nurse enters ; she rubs a match and lights the gas.
There is no answer. Nurse comes in ; she strikes a match, and lights the gas.



Quelque chose dégringole dans la cheminée et tombe sur le plancher
Some thing tumbles down in the chimney and falls upon the floor.
Something tumbles down the chimney and falls on the floor.

Jeannette crie. La bonne dit : "Chut ! Vous allez réveiller Bébé."
Jenny cries. The nurse says : "Hush ! You go to awaken Baby."
Jenny screams. Nurse says : "Hush ! You will waken Baby."

"C'est un petit chat," dis-je. "Il a peur. Puis-je lui donner du lait ?"
"This is a little cat," say I. "He has fear. May I to him to give some milk ?"
"It is a kitten," I say. "He is frightened. May I give him some milk ?"

La bonne tire la sonnette et la servante apporte du lait dans une soucoupe.
The nurse pulls the bell and the servant brings some milk in a saucer.
Nurse rings the bell, and the maid brings some milk in a saucer.

Bébé s'éveille et crie : "Joli minet ! Puis-je l'avoir dans mon lit ?"
Baby herself awakes and cries : "Pretty pussy ! May I him to have in my bed ?"
Baby wakes up and cries : "Pretty pussy ! May I have him in my bed ?"

Mais la bonne dit : "Nous le mettrons dans cette corbeille près du feu."
But the nurse says : "We him will put in this basket near of the fire."
But Nurse says : "We will put him in this basket near the fire."

Le matin il est parti. Peut-être les fées l'ont emporté.
The morning he is departed. Perhaps the fairies him have carried away.
In the morning he was gone. Perhaps the fairies have taken him away.

A FRENCH LESSON IN PICTURE: THE NAMES OF FAMILIAR OBJECTS IN THE COUNTRY

This picture teaches us the French names of familiar things in country life. Reading from the left we have the roof, window, and bell of a little house, and a cyclist on a bicycle. A shop with its chimney-pots and their smoke, its shutters, door, plate-glass window, and the owner's name, Durand—as familiar in France as our Smith or Jones—is a background to a woman and her baby and an automobile, with its chauffeur, lady and child, wheels, lantern, and dust. To the right are the pathway, palings, tree, and the footpath to the cottage. Then comes a horse pulling a gig, with reins and whip, along the road past a milestone. Beyond is the plough in the field; hills, clouds, and sky above.

A POEM ABOUT THE VIKINGS

THIS fine poem suggests something of the fierce spirit of the Vikings, those warriors of the sea whose home was in that part of Europe we call Scandinavia. When a Viking chief died, his body was placed in a boat, which, with full sail set and a fire lighted, was sent drifting out to sea. As the fire consumed the vessel and the body of the dead, it was supposed that the chief thus made his last journey, entering into Valhalla, the land of the gods. In this stirring poem of King Balder's funeral voyage, the tragic interest is the greater from the fact that the king is not dead when he sets sail for Valhalla, but is voluntarily going forth to his fate. The king is named after one of the gods in the Norse mythology, and we must admire the indomitable spirit of these old pagans, whose stories of their imaginary gods are full of a beautiful bravery. This poem was written by Charles Mackay, a well-known poet and journalist, who was born in 1814 and died in 1889.

THE SEA-KING'S BURIAL

CONTINUED FROM 3406

"MY strength is failing fast,"
Said the sea-king to his men,
"I shall never sail the seas
Like a conqueror again,
But while yet a drop remains
Of the life-blood in my veins,
Raise, oh, raise me from my bed;
Put the crown upon my head;
Put my good sword in my hand,
And so lead me to the strand,
Where my ship at anchor rides
Steadily;
If I cannot end my life
In the crimsoned battle-strife,
Let me die as I have lived,
On the sea."

They have raised King Balder up,
Put his crown upon his head;
They have sheathed his limbs in mail,
And the purple o'er him spread;
And amid the greeting rude
Of a gathering multitude,
Borne him slowly to the shore—
All the energy of yore
From his dim eyes flashing forth—
Old sea-lion of the North—
As he looked upon his ship
Riding free,
And on his forehead pale
Felt the cold, refreshing gale,
And heard the welcome sound
Of the sea.

They have borne him to the ship
With a slow and solemn tread;
They have placed him on the deck
With his crown upon his head,
Where he sat as on a throne;
And have left him there alone,
With his anchor ready weighed,
And his snowy sails displayed
To the favouring wind, once more
Blowing freshly from the shore,
And have bidden him farewell
Tenderly,
Saying: "King of mighty men,
We shall meet thee yet again,
In Valhalla, with the monarchs
Of the sea."

Underneath him in the hold
They had placed the lighted brand;
And the fire was burning slow
As the vessel from the land,
Like a stag-hound from the slips,
Darted forth from out the ships.
There was music in her sail
As it swelled before the gale,
And a dashing at her prow
As it cleft the waves below,
And the good ship sped along,
Scudding free;
As on many a battle morn
In her time she had been borne,
To struggle, and to conquer
On the sea.

And the king with sudden strength
Started up, and paced the deck,
With his good sword for his staff,
And his robe around his neck.
Once alone, he raised his hand
To the people on the land;
And with shout and joyous cry
Once again they made reply,
Till the loud, exulting cheer
Sounded faintly on his ear;
For the gale was over him blowing
Fresh and free;
And ere yet an hour had passed,
He was driven before the blast,
And a storm was on his path,
On the sea.

"So blow, ye tempests, blow,
And my spirit shall not quail;
I have fought with many a foe,
I have weathered many a gale;
And in this hour of death,
Ere I yield my fleeting breath—
Ere the fire now burning slow
Shall come rushing from below,
And this worn and wasted frame
Be devoted to the flame—
I will raise my voice in triumph,
Singing free;
To the great All-Father's home
I am driving through the foam,
I am sailing to Valhalla,
O'er the sea.

" So blow, ye stormy winds—
  And, ye flames, ascend on high ;
In easy, idle bed
  Let the slave and coward die !
But give me the driving keel,
Clang of shields and flashing steel ;
Or my foot on foreign ground,
With my enemies around !
Happy, happy, thus I'd yield,
On the deck or in the field,
  My last breath, shouting ' On
      To victory.'
But since this has been denied,
They shall say that I have died
  Without flinching, like a monarch
      Of the sea."

And Balder spoke no more,
  And no sound escaped his lip ;
And he looked, yet scarcely saw
  The destruction of his ship,
Nor the fleet sparks mounting high,
Nor the glare upon the sky ;
Scarcely heard the billows dash,
Nor the burning timber crash ;
Scarcely felt the scorching heat
That was gathering at his feet,
  Nor the fierce flames mounting o'er him
      Greedily,
But the life was in him yet,
And the courage to forget
  All his pain, in his triumph
      On the sea.

Once alone, a cry arose,
  Half of anguish, half of pride,
As he sprang upon his feet,
  With the flames on every side.
" I am coming ! " said the king,
" Where the swords and bucklers ring—
Where the warrior lives again,
Where the souls of mighty men—
Where the weary find repose,
And the red wine ever flows.
  I am coming, great All-Father,
      Unto Thee !
Unto Odin, unto Thor,
And the strong, true hearts of yore—
  I am coming to Valhalla,
      O'er the sea."

* UNCLE SAM'S YOUNG ARMY

This stirring little piece comes from the pen of Mrs. Lilla T. Elder, and has a wonderful swing of enthusiasm in its lines.

WE are Uncle Sam's young army,
  And we're twenty million strong—
All together we are marching,
  Marching, marching right along.
Not one coward is among us,
  Every heart is staunch and true ;
And although we are but children,
  Yet there's something we can do :
We can guard our country's colours,
  Raise them high with cheer and song.
For we're Uncle Sam's young army,
  And we're twenty million strong.

Well we know the splendid stories
  Of the brave deeds of the past,
And our country we have promised
  That such bravery shall last.
Loyal we will be and love her,
  True in every word and deed,
That we may be worthy of her
  When it comes our turn to lead.
Now we can but guard her colours,
  Proud that to us they belong :
For we're Uncle Sam's young army,
  And we're twenty million strong.

And although the smoke of battle
  Shadows our dear land to-day,
Still we little colour-bearers
  With the flag can light the way.
See, how glad are all to cheer it.
  Praises come from every mouth.
One great nation kneels to bless it,
  East and West and North and South.
All together we are marching,
  Marching, marching right along—
For we're Uncle Sam's young army,
  And we're twenty million strong.

THE LAME BROTHER

Mary Lamb, the sister of Charles Lamb, had a very sad life and was subject to fits of mania. Her brother Charles devoted himself to watching over her and protecting her. Their literary labors together did much to brighten and make useful the life of the sister, who, though greatly inferior to her brother in literary gifts, had still a talent for pleasant and simple verse. Their elder brother, John, had been lamed in his youth, and these verses by Mary Lamb were, no doubt, suggested by the infirmity of her brother.

MY parents sleep both in one grave ;
  My only friend's a brother.
The dearest things upon the earth
  We are to one another.

A fine stout boy I knew him once,
  With active form and limb ;
Whene'er he leaped, or jumped, or ran,
  Oh, I was proud of him !

He leaped too far, he got a hurt,
  He now does limping go—
When I think on his active days,
  My heart is full of woe.

He leans on me, when we to school
  Do every morning walk ;
I cheer him on his weary way,
  He loves to hear my talk :

The theme of which is mostly this,
  What things he once could do.
He listens pleased—then sadly says,
  " Sister, I lean on you."

Then I reply, " Indeed you're not
  Scarce any weight at all—
And let us now still younger years
  To memory recall.

" Led by your little elder hand,
  I learned to walk alone ;
Careful you used to be of me,
  My little brother John.

" How often, when my young feet tired,
  You've carried me a mile !
And still together we can sit,
  And rest a little while.

" For our kind Master never minds,
  If we're the very last ;
He bids us never tire ourselves
  With walking on too fast."

A CHRISTMAS CAROL

THERE'S a song in the air!
There's a star in the sky!
There's a mother's deep prayer
And a baby's low cry!
And the star rains its fire while the Beautiful sing,
For the manger of Bethlehem cradles a king.

There's a tumult of joy
O'er the wonderful birth,
For the virgin's sweet boy
Is the Lord of the earth.
Ay! the star rains its fire and the Beautiful sing,
For the manger of Bethlehem cradles a king.

In the light of that star
Lie the ages impearled;
And that song from afar
Has swept over the world.
Every hearth is aflame, and the Beautiful sing
In the homes of the nations that Jesus is King.

We rejoice in the light,
And we echo the song
That comes down through the night
From the heavenly throng.
Ay! we shout to the lovely evangel they bring,
And we greet in his cradle our Saviour and King.

JOSIAH GILBERT HOLLAND.

THE CHILDREN'S HOUR

This is one of the most charming of the minor poems by H. W. Longfellow, and it pictures for us with real feeling one of the greatest joys of life: the story-telling hour with the little ones. The story of the Bishop of Bingen, mentioned in the fourth verse, is told at length in Southey's poem of "Bishop Hatto."

BETWEEN the dark and the daylight, when the night is beginning to lower,
Comes a pause in the day's occupations, that is known as the Children's Hour.
I hear in the chamber above me the patter of little feet,
The sound of a door that is opened, and voices soft and sweet.

From my study I see in the lamplight, descending the broad hall stair,
Grave Alice, and laughing Allegra, and Edith with golden hair.
A whisper and then a silence; yet I know by their merry eyes
They are plotting and planning together to take me by surprise.

A sudden rush from the stairway, a sudden raid from the hall!
By three doors left unguarded they enter my castle wall!
They climb up into my turret o'er the arms and back of my chair;
If I try to escape they surround me; they seem to be everywhere.
They almost devour me with kisses, their arms about me entwine,
Till I think of the Bishop of Bingen, in his Mouse-tower on the Rhine!
Do you think, oh, blue-eyed banditti, because you have scaled the wall,
Such an old moustache as I am is not a match for you all?

I have you fast in my fortress, and will not let you depart,
But put you down into the dungeon in the round-tower of my heart.
And there will I keep you for ever, yes, for ever and a day,
Till the walls shall crumble to ruin, and moulder in dust away.

HOW TO WRITE A LETTER

In the early years of last century, when children's books were very quaint productions, chiefly concerned with illustrating the awful results of naughty conduct, a Mrs. Elizabeth Turner wrote many of these little works, such as "The Cowslip" and "The Daisy," which were meant to be "cautionary" stories for children, but to-day would be more likely to amuse young readers than to caution them. The following verses by Mrs. Turner, however, are quite happy, and may be commended as the best possible advice to those who find it difficult to write a letter—young and old alike. Mrs. Turner died in 1846 at the age of seventy-two.

MARIA intended a letter to write,
But could not begin (as she thought) to indite;
So went to her mother with pencil and slate,
Containing "Dear Sister," and also a date.

"With nothing to say, my dear girl, do not think
Of wasting your time over paper and ink;
But certainly this is an excellent way,
To try with your slate to find something to say.

"I will give you a rule," said her mother, "my dear,
Just think for a moment your sister is here,
And what would you tell her? consider, and then,
Though silent your tongue, you can speak with your pen."

*GOD SENDS LOVE TO YOU

There are few stories in the Old Testament more beautiful than that of Naaman and the little Jewish maid Ruahmah, which tells us of how that young captive contrived to teach her master about the love of God. Dr. Van Dyke, an American poet of to-day, has written a beautiful play, entitled "The House of Rimmon," which deals with this subject, and Ruahmah is therein made to sing the following beautiful song.

ABOVE the edge of dark appear the lances of the sun;
Along the mountain ridges clear his rosy heralds run;
The vapours down the valley go,
Like broken armies, dark and low.
Look up, my heart, from every hill
In folds of rose and daffodil
The sunrise banners flow.

Oh, fly away on silent wing, ye boding owls of night!
Oh, welcome, little birds that sing the coming-in of light!
For new, and new, and ever new,
The golden bud within the blue;
And every morning seems to say:
"There's something happy on the way,
And God sends love to you!"

SEVEN TIMES ONE

"Seven Times One" was written by Jean Ingelow, and is the first in a series of poems called the "Songs of the Seven." It tells the thoughts of a little girl upon her seventh birthday.

THERE'S no dew left on the daisies and clover,
There's no rain left in heaven.
I've said my "seven times" over and over—
Seven times one are seven.

I am old—so old I can write a letter;
My birthday lessons are done.
The lambs play always—they know no better;
They are only one times one.

O Moon, in the night I have seen you sailing
And shining so round and low.
You were bright—ah, bright!—but your light is failing;
You are nothing now but a bow.

You Moon, have you done something wrong in heaven,
That God has hidden your face?
I hope, if you have, you will soon be forgiven,
And shine again in your place.

O Columbine, open your folded wrapper,
Where two twin turtle-doves dwell.
O Cuckoo-pint, toll me the purple clapper
That hangs in your clear green bell.

And show me your nest, with the young ones in it,
I will not steal them away.
I am old, you may trust me, linnet, linnet,
I am seven times one to-day.

THE KITTEN AND THE FALLING LEAVES

Although the subject of this poem by William Wordsworth is rather commonplace, the poet has treated it with a delicacy that makes it interesting alike to young people and grown-ups.

SEE the kitten on the wall,
Sporting with the leaves that fall,
Withered leaves—one—two—and three—
From the lofty elder-tree!
Through the calm and frosty air
Of this morning bright and fair,
Eddying round and round they sink
Softly, slowly: one might think,
From the motions that are made,
Every little leaf conveyed
Sylph or fairy hither tending,
To this lower world descending,
Each invisible and mute,
In his wavering parachute.
—But the kitten, how she starts,
Crouches, stretches, paws, and darts!
First at one, and then its fellow,
Just as light and just as yellow;
There are many now—now one—
Now they stop and there are none:
What intenseness of desire
In her upward eye of fire!
With a tiger-leap half-way
Now she meets the coming prey,
Lets it go as fast, and then
Has it in her power again:
How she works with three or four,
Like an Indian conjuror;
Quick as he in feats of art,
Far beyond in joy of heart.
Were her antics played in the eye
Of a thousand standers-by,
Clapping hands with shouts and stare,
What would little Tabby care
For the plaudits of the crowd?
Over happy to be proud,
Over wealthy in the treasure
Of her own exceeding pleasure!

THE BURIAL OF THE LINNET

Mrs. Ewing, who lived from 1842 to 1885, was in her day an extremely popular writer for the young, and many of her stories are still in circulation. She also wrote poetry, of which the following is an example, but she is better remembered for her charming stories of quiet everyday life.

FOUND in the garden dead in his beauty—
Oh that a linnet should die in the spring!
Bury him, comrades, in pitiful duty,
Muffle the dinner-bell, solemnly ring.

Bury him kindly, up in the corner;
Bird, beast, and goldfish are sepulchred there.
Bid the black kitten march as chief mourner,
Waving her tail like a plume in the air.

Bury him nobly—next to the donkey;
Fetch the old banner, and wave it about;
Bury him deeply—think of the monkey,
Shallow his grave, and the dogs get him out.

Bury him softly—white wool around him,
Kiss his poor feathers—the first kiss and last;
Tell his poor widow kind friends have found him:
Plant his poor grave with whatever grows fast.

Farewell, sweet singer! dead in thy beauty,
Silent through summer, though other birds sing.
Bury him, comrades in pitiful duty,
Muffle the dinner-bell, mournfully ring.

TRY AGAIN

These familiar lines by William Edward Hickson have been as often quoted as some of the finest poetry in our language, although, of course, they are only rhymes for children. It is the idea here, rather than the form in which it is expressed, that makes the words worthy of quotation. Hickson wrote on educational matters, and lived from 1803 to 1870,

'TIS a lesson you should heed,
Try again;
If at first you don't succeed,
Try again;
Then your courage should appear,
For if you will *persevere*,
You will conquer, never fear,
Try again.

Once or twice, though you should fail,
Try again;
If you would at last prevail,
Try again;
If we strive, 'tis no disgrace
Though we do not win the race;
What should we do in that case?
Try again.

If you find your task is hard,
Try again;
Time will bring you your reward,
Try again;
All that other folk can do,
Why, with patience, may not you?
Only keep this rule in view,
Try again.

LITTLE VERSES FOR VERY LITTLE PEOPLE

ONE, two, three, four, five,
Once I caught a fish alive,
Six, seven, eight, nine, ten,
But I let him go again.

Why did you let him go?
Because he bit my finger so.
Which finger did he bite?
The little one upon the right.

POOR Dicky's dead! The bell we toll,
And lay him in the deep, dark hole.
The sun may shine, the clouds may rain,
But Dick will never pipe again!
His quilt will be as sweet as ours:
Bright buttercups and cuckoo flowers.

I LOVE the little flowers;
I love the little plants;
I love the little butterflies,
And I'm not afraid of ants.
But I do not love the bumble bee,
And the waspies really frighten me!

OH, my pretty cock! Oh, my handsome cock!
I pray you, do not crow before day,
And your comb shall be made of the very beaten gold,
And your wings of the silver so gray.

DANCE, little baby, dance up high,
Never mind, baby, mother is by;
Crow and caper, caper and crow,
There, little baby, there you go;
Up to the ceiling, down to the ground,
Backwards and forwards, round and round;
Dance, little baby, and mother will sing,
With the merry carol, ding, ding, ding!

I'M going out a-hunting,
I'm going to have some fun,
But there will be no danger,
Although I have a gun.

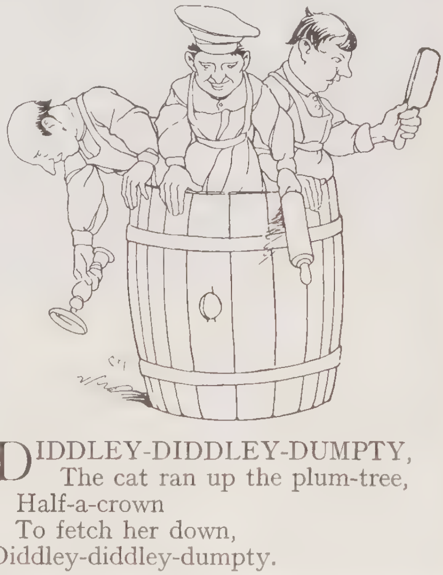
Storks, pigeons, and canaries,
I'll bring home without fail;
For I'll load my trusty gun with salt,
And shoot them on the tail!

YOU see, merry Phillis, that dear little maid,
Has invited Belinda to tea.
Her nice little garden is shaded by trees,
What pleasanter place could there be?

There's a cake full of plums, there are strawberries too,
And the table is set on the green;
I'm fond of a carpet all daisies and grass,
Could a prettier picture be seen?

A blackbird (yes, blackbirds delight in warm weather),
Is flitting from yonder high spray.
He sees the two little ones talking together,
No wonder the blackbird is gay.

RUB-A-DUB-DUB,
Three men in a tub;
The butcher, the baker,
The candlestick-maker;
And they all jumped out of a rotten potato.



DIDDLEY-DIDDLEY-DUMPTY,
The cat ran up the plum-tree,
Half-a-crown
To fetch her down,
Diddley-diddley-dumpty.

MY house is red—a little house,
  A happy child am I:
I laugh and play the livelong day,
  I hardly ever cry.

I have a tree, a green, green tree,
  To shade me from the sun;
And under it I often sit,
  When all my work is done.

My little basket I will take,
  And trip into the town.
When next I'm there I'll buy some cake,
  And spend my bright half-crown.

I LOVE little pussy.
  Her coat is so warm,
And if I don't hurt her,
  She'll do me no harm.

So I'll not pull her tail,
  Or drive her away,
But pussy and I
  Very gently will play.

She will sit by my side,
  And I'll give her her food,
And she'll like me because
  I am gentle and good.

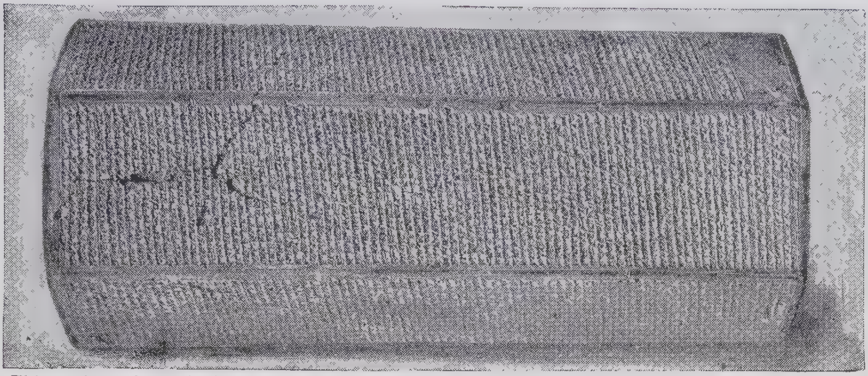
A CHILD'S EVENING PRAYER

Words by ALFRED P. GRAVES.

Music by permission of MESSRS. SCHOTT & CO.

"All the people in all lands
Take unto Your loving hands;
Old and young and great and small,
From all danger guard them all!

"Give the sick ones gentle sleep,
Dry the eyes of those that weep,
And, please, leave the moon to ligh
All poor travelers through the night!"



This curious clay cylinder, with dents all over, is an ancient Assyrian history book from Nineveh.

HOW MEN LEARNED TO WRITE

Continued from 3412

WHAT a different place the world would be if no one had ever learned how to write! We should have no telephones, no aeroplanes, no telegraphs, or trains, no newspapers. We should know nothing about how our forefathers fought for liberty and won it. We should know nothing about the great men of the past. We should live in dense, dark ignorance of all that goes on in this great world, except in our own little corner of it.

You will begin perhaps to think that writing is the greatest invention in the world; but the fact of it is that the art of writing grew so gradually and naturally that it can scarcely be said to be an invention at all. Of course, like everything else that man does, writing had a beginning; but it was such a beginning as a baby makes when he demands a pencil and paper so that he may " draw pictures."

In very early times, people began to make pictures of the animals that they hunted in the chase, or that roamed through the woods about them. At first, no doubt, the pictures were just as crude as the pictures made by baby hands, but by and by the skill of these early artists increased. They ornamented pieces of bone and horn and the walls of the caves in which they lived with pictures of men and animals. Some of the pictures, as you can see on the next page, were wonderfully well done, and must have been cherished by their owners among their greatest treasures. Probably these bone and horn pictures were often sent as gifts of friendship from the head or chief of a family or tribe to the head or chief of another. Soon the carved figures in the pictures were used as symbols to convey messages. But if, for instance, one chief sent another an invitation to a feast, while the second man thought it was a threat of war, dire confusion would be the result. So it naturally came about that it was agreed that the pictures of certain animals should always be used as symbols to mean certain things, and that is how writing began.

As the years went on, and the chiefs of tribes became great men and kings of nations, they were not satisfied that their deeds should be handed down only by word of mouth. They feared that remembrance of what they had done might be lost, or that an enemy might tell another tale. So they began to set them down, not in books such as we have, for they had none, but on stone, or, where they had no stone, on tiles or bricks.

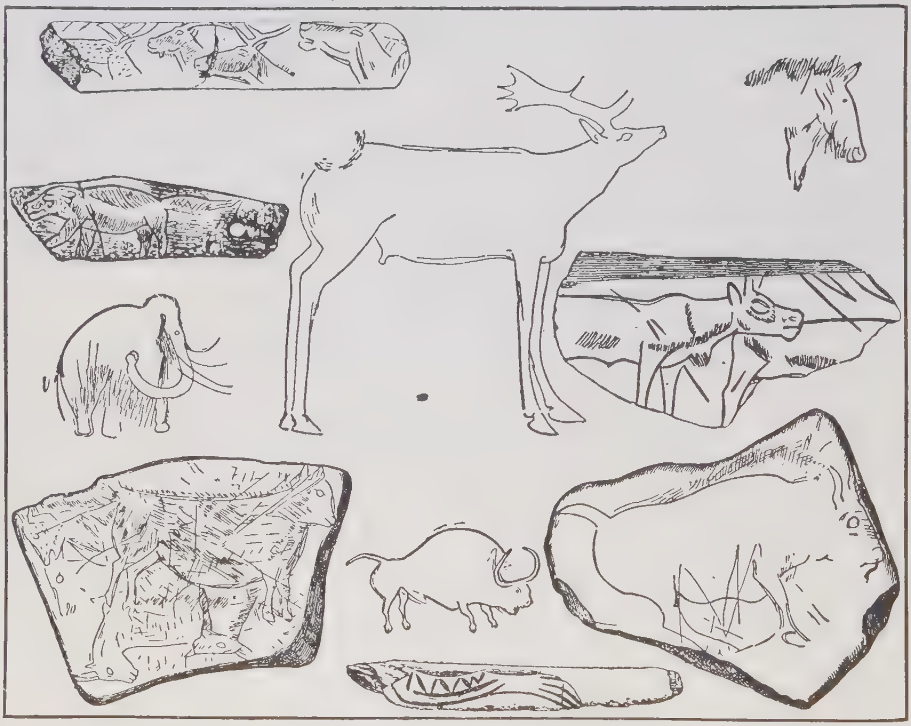
As we have read in the story of ancient Egypt, the Egyptians wrote their early books in beautiful picture writing which we call hieroglyphics.

This writing was carved on their pillars and painted on the walls of their temples and palaces and tombs or written on books of linen or papyrus. The Babylonians had a different kind of writing, which was called the cuneiform, because it looks as if the signs were made up of arrow heads.

HOW THE BABYLONIANS AND ASSYRIANS LEARNED TO WRITE

The Sumerians, who lived in Mesopotamia, where there was no stone, and had to build their cities of brick, used clay tablets or cylinders for books. The writing was done by pressing an instrument into the damp clay, and this made the clay spread at one end, so that the mark looked something like an arrow head. After the writing was done, the tablet was dried in the hot sun, or burned in a kiln. It was difficult of course to make pictures in this way, and gradually the signs became conventionalized, that is, they were made with such simple lines that they ceased to look like birds and animals, and became the oddly-shaped lines of cuneiform writing. The Babylonians learned this writing from the Sumerians. In their turn the Assyrians learned to write from the Babylonians, and when Athens was yet unbuilt, and the seven hills of Rome were wooded slopes, the city of Nineveh had a great library, with shelves laden with thousands of books written on clay tablets.

We must remember that few people who lived in the days of which we have been reading could learn to read, and fewer still to write. There was no such thing as an easy alphabet of twenty-six simple letters from which all the words in the language could be built up. Every sign meant a word or a syllable, and each of these signs had to be learned and remembered.



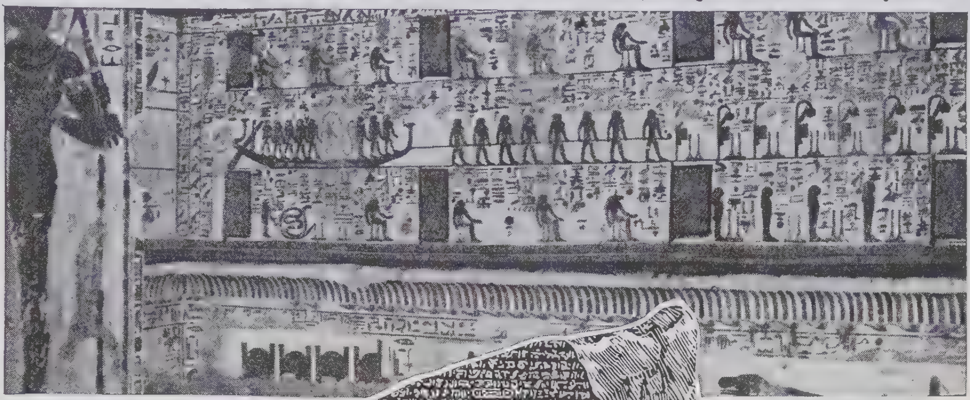
These pictures show how the earliest men wrote. They were scratched on bone or rock by prehistoric men; most of them were found in caves. From pictures, men developed signs for words and letters.

HOW THE ALPHABET WAS MADE AND A KNOWLEDGE OF WRITING SPREAD

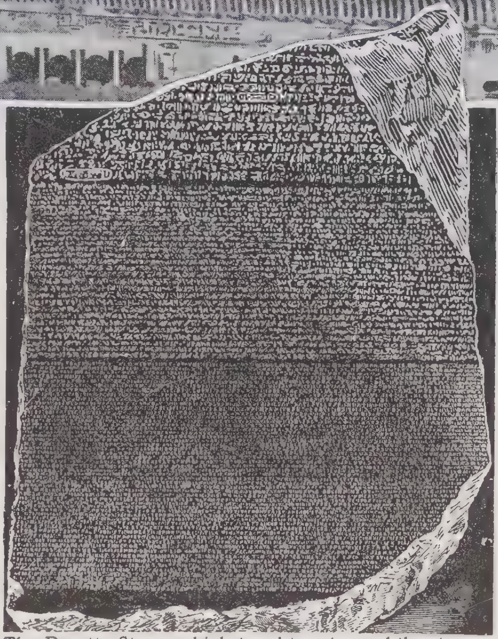
This did well enough for a time, but as ideas grew and men learned more about life and the world in which they lived, they needed a larger number of signs than they had in the beginning. The Egyptian priests tried to overcome the difficulty by using pictures for letters as well as for signs for words and syllables. Other peoples of the East went farther still. They used signs to represent sounds instead of words, and from these signs they built

HOW THE WORLD'S STORY WAS FIRST TOLD

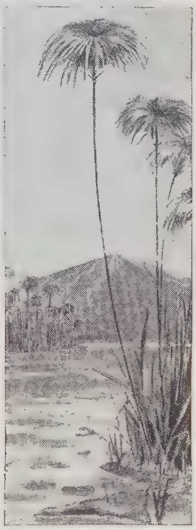
The Egyptians painted the walls of their temples and tombs with letters and pictures which tell the history of Egypt. This is from the wall of a tomb where the paint is still fresh, though it is thousands of years old.



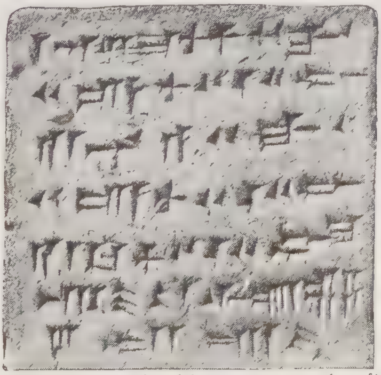
Cleopatra's Needle, once in Egypt, and now in Central Park, New York, shows the writing on the Egyptian monuments.



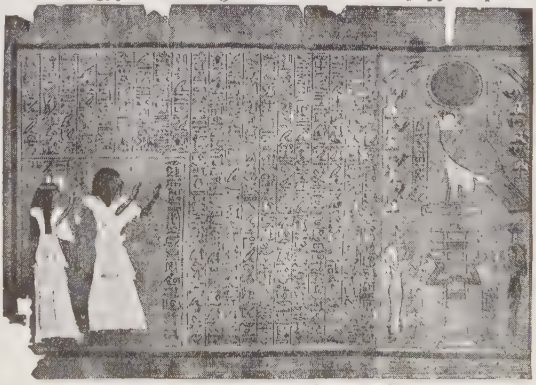
The Rosetta Stone, which taught us to read the strange writing the Egyptians left behind. It said the same thing in three kinds of writing, and one was Egyptian. Men knew one of the other kinds of writing, so that they were able to find out what the Egyptian writing meant.



There was no paper in old Egypt, and the people wrote on bricks and sheets made from the stem of the papyrus plant.



An early way of writing was to mark soft clay and bake it into a brick like this.



This is a piece of papyrus, showing how the Egyptians used it to write upon. It was made from strips of the papyrus plant.

up words. In course of time, the signs used became simpler in form and fewer in number, and at length the alphabet which the Greeks learned from the Phœnicians appeared.

When your fathers and mothers went to school, they were probably taught that the Phœnicians invented their alphabet, but we know now that they only took the simplest signs from an earlier system of hieroglyphic or picture writing and used them to represent the sounds that they heard in the human voice. Many scholars now think that they got these signs from the Egyptians, others say that they learned them from some of the Syrian peoples, and others again say that they may have got them in Crete. At any rate the Phœnicians taught this new way of writing, with an alphabet, to the Greeks, who added signs for vowel sounds which the Phœnicians had not used, and gave the alphabet its name. Long afterward, the Greeks taught it to the Romans.

The Latin tongue, which was spoken by the Romans, became the language of the church and missionaries of the church spread a knowledge of writing through the nations of western Europe, and it is the Roman alphabet that we use.

HOW THE ALPHABET USED BY THE SLAV NATIONS WAS MADE

In the ninth century, the Moravians and Bohemians, Slav peoples of whom we read in the story of Austria-Hungary, were converted to Christianity by a Greek monk named Cyril. Cyril, who was a learned man, made an alphabet in Greek characters for the Slav language, so that his new converts could learn to read and write. The Russians, who belong to the same race, also learned this alphabet, and Russian writing still bears a strong resemblance to the Greek.

You remember the beautiful story, told on another page, of how the learned Bede, in his old age, translated part of the Gospel of St. John into the English tongue. You must not think, however, that even if we could see his writing we could read it without much study. His manuscript looked like printing in queer capital letters, and not only was his language very different from the beautiful English that we now use, but there were no spaces between his words, and he knew nothing about the punctuation that makes our writing so easy to read. As books multiplied and libraries grew larger, the monks, who copied most of the manuscripts, learned to make their letters smaller and large letters were used only as capitals for the beginning of sentences. Monks toiled ceaselessly in their convent cells to make copies of books, and many monasteries became famous for their beautifully written manuscripts, with exquisitely painted borders and initial letters.

WHERE THE EARLY PRINTERS GOT LETTERS TO MAKE TYPE

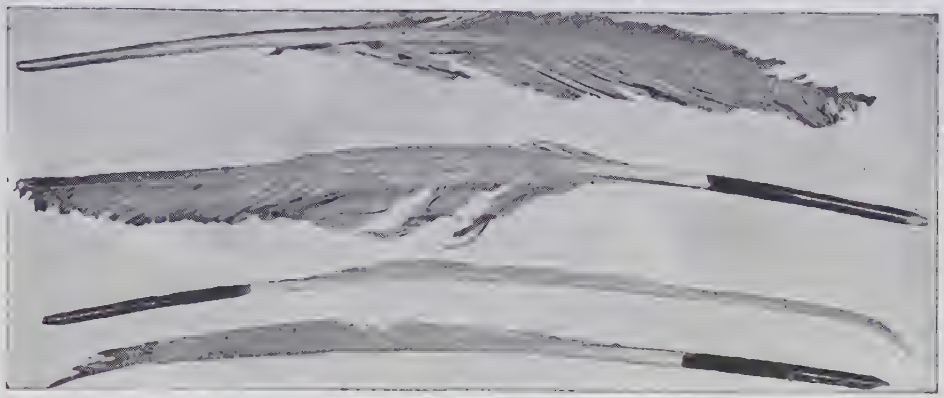
Of course, many men besides the monks learned to write in the Middle Ages. Merchants and lawyers, the secretaries of great men and many others found it necessary to learn to read and write. These people could not take time to write beautiful manuscripts, and rapid writing, with the letters of each word joined to one another, came into use. When the printing press was invented, however, it was the beautiful "book hand" writing of the monks that was adopted by the printers and from that comes the clear print which you are reading in this book to-day.

THE STORY OF THE ROSETTA STONE

In the course of ages, the writing of the Egyptians and Babylonians was forgotten. Men knew that the pictures in the temples and monuments told a tale of ancient glories, but no man could read the story. At length, when even the most learned men had almost given up trying to find out what the strange writing meant, the Rosetta stone, of which we read in the story of Egypt, was brought to light. It was found at Rosetta in Egypt by some French officers of Napoleon's army and was afterward brought to England, where it was studied by many scholars before its meaning was made clear.

The inscription is in three different kinds of writing, Greek, *demotic*—the name given to what we may call the business writing of the Egyptians—and hieroglyphics. Some of the words in the demotic writing were first learned. Then Dr. Thomas Young, an Englishman, was able to fix the sounds of some of the hieroglyphic signs. A French scientist named Jean François Champollion picked up the clue and after much patient study learned to read the hieroglyphics. He found that, for instance, an eagle stood for the letter *a*, a leg and foot for *b*, an owl for *m*, a chicken for *u*. A man with his hands lifted up meant the word prayer.

MAKING PENS FROM A BIRD'S FEATHERS



For about 1,200 years before the 19th century, quill pens, made from feathers of the goose, swan, or turkey, were universally used. Millions of quill pens are still made in England for use in offices and courts of law.

The first process in making quill pens is to harden the quills by heating them in a vessel as the man in this picture is doing.

They are then carefully examined by an expert workman, and those suitable for the purpose for which they are intended are put together, ready for the cutter, who shapes the nib.

The cutter with a few strokes of his knife produces the finished pen. Men who do this work are very skilful and quick, and make hundreds of pens, in a very short time, without spoiling any.

The quill pens are then tied together in bundles, ready for the shops. Of course the industry is declining every year.

In the meantime the inscriptions on the rock of Behistun, of which we read on page 5148, had been found. Sir Henry Rawlinson climbed a ladder from a narrow ledge of rock to copy the inscriptions, and from them he was able to learn the meaning of the cuneiform writing in which the history of Babylon and Nineveh had been written.

The Chinese never learned to use an alphabet, and to this day little Chinese boys have to learn thousands of word signs or idiograms so as to be able to read and write.

THE EGYPTIANS WROTE ON PAPYRUS

And now we ask ourselves on what were all the books written, for, of course, we know the manuscripts of the Middle Ages were not written on clay or stone. Indeed, the Egyptians did not write all their books on stone. Even though Moses wrote the law on tables of stone, he probably knew how to write on papyrus rolls, which were used before his time.

The Greeks and Romans used papyri also, but their laws and public records in early times were written on stone tables and bronze tablets. All down through Roman history the Romans who could write carried about with them tablets made of wood or metal covered with wax, on which they wrote with a sharp iron instrument called a stylus. The Egyptians had learned to make parchment from the skins of animals, before the time that the Israelites came out of Egypt. It was used to write on five hundred years before the birth of Christ, and the Greeks and Romans used it to write some of the great books that have come down to us from their time. When papyrus became scarce parchment came more into use. All the beautiful, illuminated manuscripts of medieval times were written on parchment, or vellum. Vellum, which is a fine kind of parchment, is made from the skins of very young animals. Even after the introduction of printing, parchment was used. It is said that Matthias Hunyadi, of Hungary, of whom we read in the story of that country, would not have a printed book in his library, and kept a large staff of copyists at work copying his books.

THE CHINESE INVENTED PAPER LONG BEFORE IT REACHED EUROPE

Paper was invented in China by a man named Tsai Lun, a high official in the empire, who lived over two thousand years ago. It was nearly a thousand years before it was brought to the western part of Asia. Late in the tenth century, however, paper was made in Egypt. During the next hundred years it was made by the Moors, and the knowledge of its manufacture was brought from Morocco to Spain. From Spain it spread to Italy, where it was made in the thirteenth century, and from Italy the knowledge was carried to France and Germany and later to England.

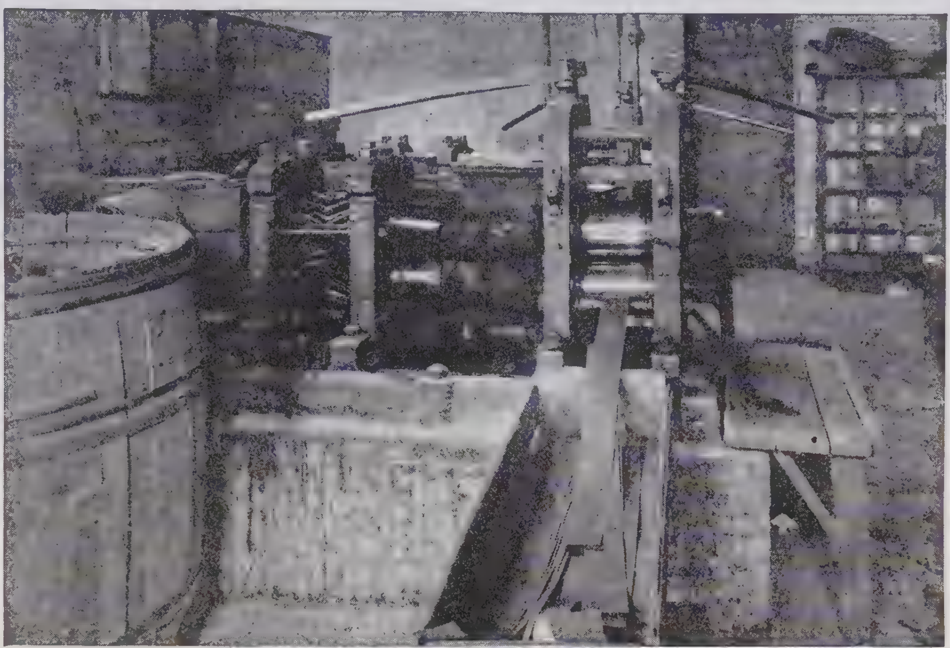
THE PENS IN USE IN ANCIENT TIMES AND IN OUR OWN

And now we ask, what kind of pens did the ancients use? Unfortunately we know little about them. The inscriptions on stone of course were cut; at first with stone instruments, later on with bronze and iron. Pens made from reeds, and split at the ends to form a kind of brush, were used by the Egyptians to write on their papyrus rolls. The Egyptians invented ink, which they made from oak-galls and sulphate of iron. Reeds were also used for writing on parchment, and their use continued down to about the thirteenth century, when copyists found out that the hollow wing feathers of birds made much better pens. Quill pens were commonly used until the nineteenth century, although it is said that a few brass pens were made in England in the end of the seventeenth century.

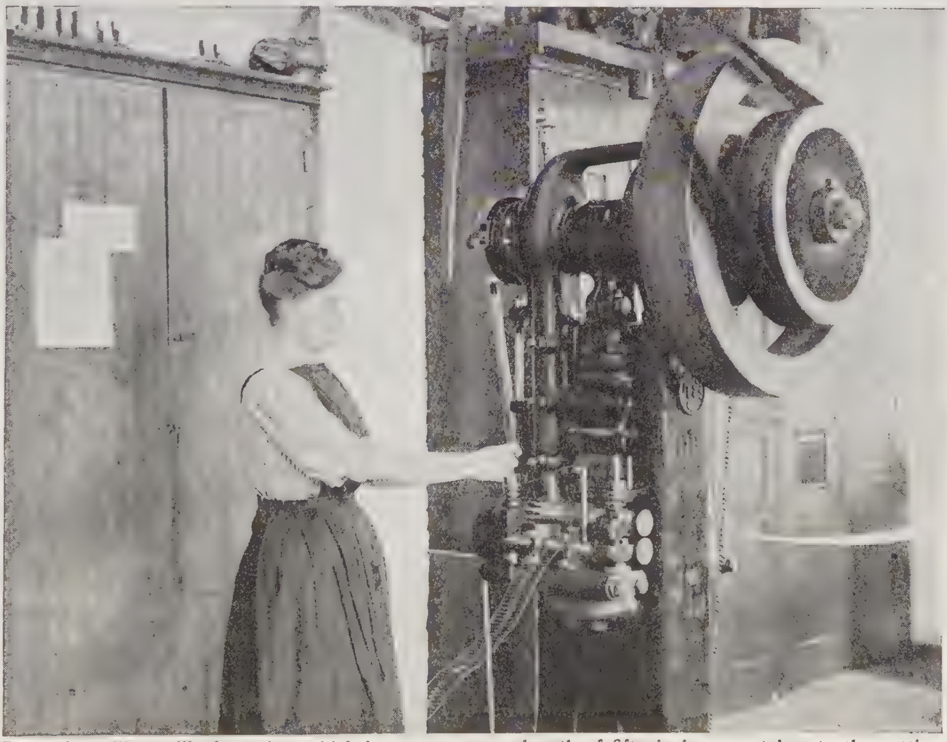
In 1819 the manufacture of steel pens was begun in England by a man named James Perry. At first they were made by hand, and were very expensive, but a few years afterward James Mitchell began to make them by machinery. He was followed by Joseph Mason and Joseph Gillot, who helped to improve steel pens and make them flexible. The early pens were shaped as much as possible like a quill, and these barrel pens, as they are called, are still sometimes used in the British Isles. Their place was generally taken, however, by the short pens which we use. Steel pens quickly took the place, in Europe and America, of the less durable quill, and many million gross are used every year. For a long time the specially hardened steel used in their manufacture was made only in England, but large quantities of it are now made in America. Some pens are made of brass and, as we read in the story of the fountain pen, gold and iridium are used also.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 3575.

HOW STEEL PENS ARE MADE



To make steel pens, sheets of hard steel, nineteen inches wide, are cut into strips about as wide as the length of two pens. These nineteen-inch strips are annealed by being kept for hours at a low red heat, in iron boxes, and then slowly cooled. The steel, which is now soft enough to work, is put through the heavy rollers, which we see here, and "cold-rolled" until the strips are thin enough to cut into pens.



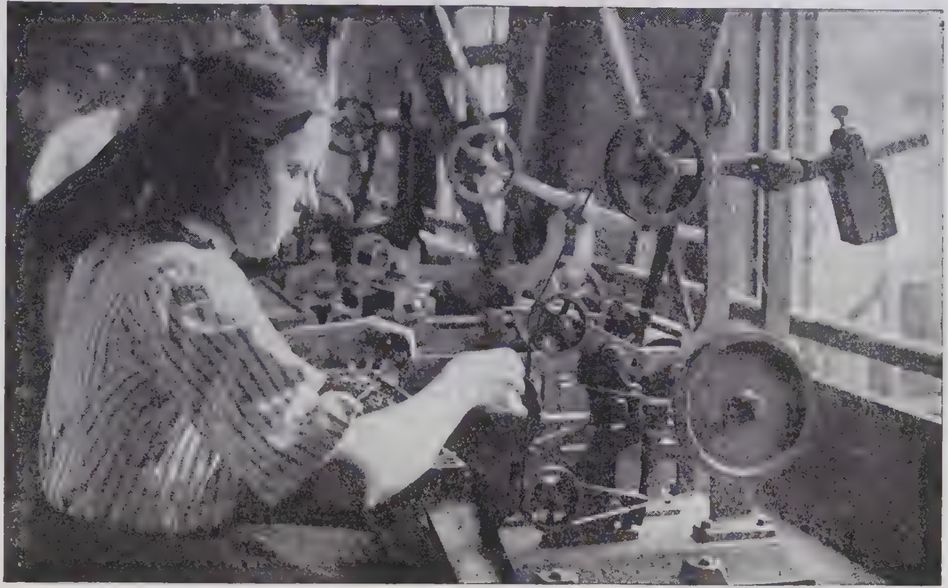
From the rolling mill, the strips, which have grown to a length of fifty inches, are taken to the cutting machine shown here. In this picture you can see the flat steel ribbon being led into the machine, and coming out, looking like a fretwork strip after the die has cut the pens, which have fallen into a box below. Pictures by courtesy of the C. Howard Hunt Pen Company.

HOW PENS ARE MARKED AND SHAPED

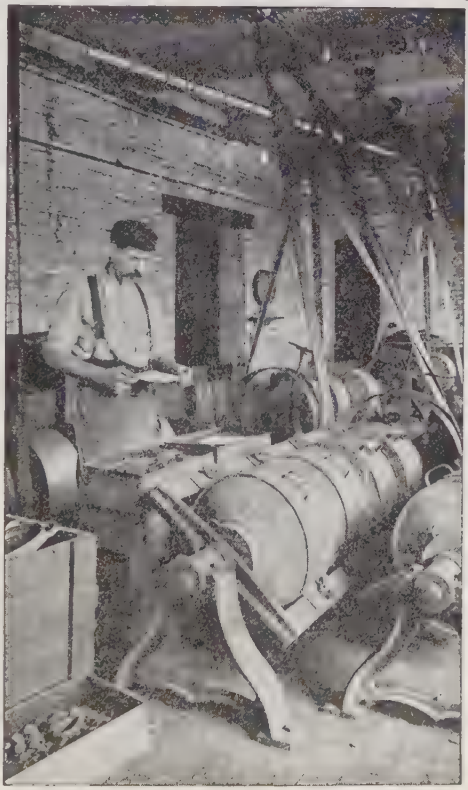
In the rolling process, the steel became very hard, and the pens are softened for marking by being kept for hours at a low red heat, and then slowly cooled in oil. They are then put through a marking press and stamped with the name of the maker and a number or letter. Then the pens are pierced and are cut at the sides.

The pens, which up to this stage have been quite flat, are now to receive the shape necessary to control the flow of ink. For this purpose the flat blanks are put into this press, which is screwed down and bends them into the required curve. They are then hardened by making them red hot and then dropping them into cold oil.

THE GRINDING AND COUNTING OF PENS

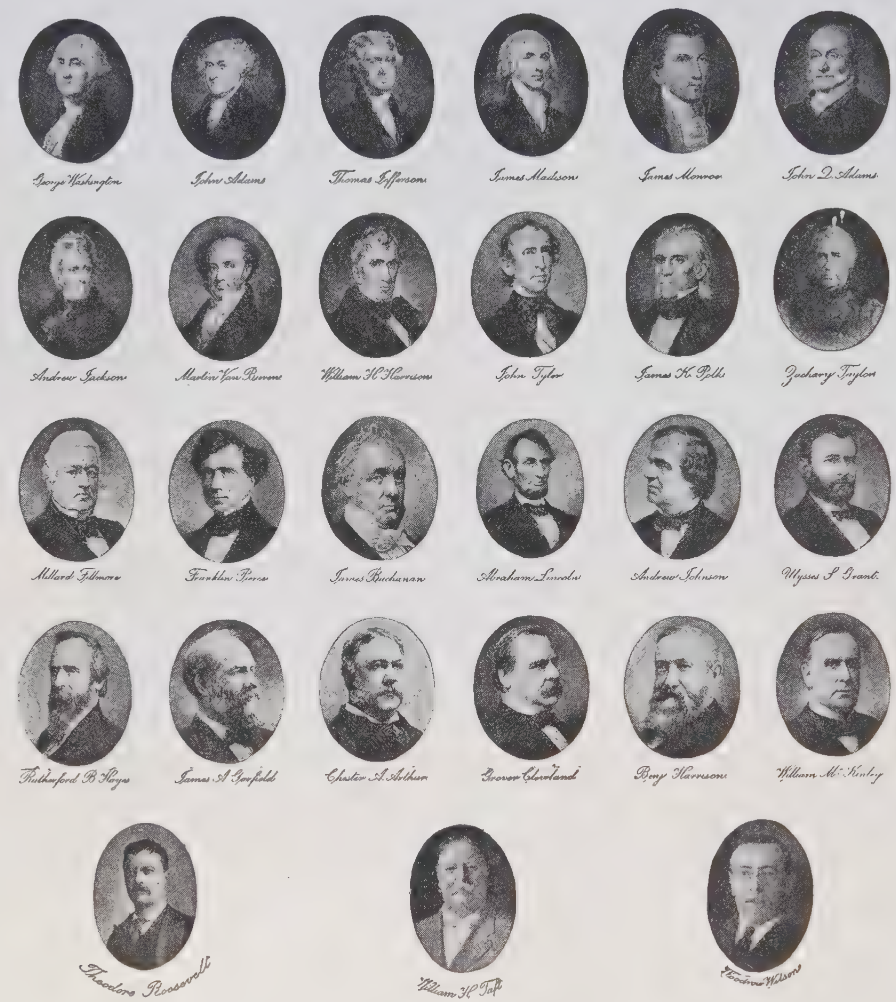


The pens are then cleaned in boiling lye, and dried in sawdust, after which they are tempered by being slowly heated and slowly cooled. The hard or soft quality of the pen depends upon its temper. The pens are then cleaned by tumbling them about with some polishing material in these tumbling barrels until they are quite bright and free from the coating of oxide, gained in the tempering process.



After the tempering has made the pens tough and elastic, and they have been cleaned, the points are ground on these emery "bobs." When this has been done they are cut right through the centre of the point by a very hard, sharp knife set in a tiny shearing machine. The points are then made round, and, as a final operation, the girl in the right-hand picture carefully examines each pen to see that it is perfect.

PRESIDENTS OF THE UNITED STATES



Here are twenty-seven men who have held the great office of President of the United States since the beginning of the government in 1789. Under them the population has grown from about four millions to more than a hundred millions, and the nation has become one of the strongest and wealthiest in the world. No king or emperor has more power than the President, but at the end of his term, or terms, he becomes a private citizen again, with no more power, or rights, than any other private individual. While there is no law to prevent a President being continued in his office for life, it has grown to be the custom to elect no man for more than two terms of four years each, and only ten of the twenty-seven had a second election. Five succeeded to the office by the death of the President. These were Tyler, Fillmore, Johnson, Arthur and Roosevelt. The last named is the only one who was then elected for a term of his own. Up to this time all our Presidents have been born east of the Mississippi River, in the older states. Fifteen have been elected from three states, Virginia, New York and Ohio, and three lived in Tennessee at the time they were elected, though it is a curious fact that all of them were born in North Carolina. The recent censuses show such a wonderful growth of population and wealth in the West, that we need not be surprised to see a President elected from the region, which was almost uninhabited seventy-five years ago. On page 2378 you may learn more about our Presidents and the states from which they came.

By courtesy of William Clausen, New York.

WHAT WE LEARN IN THIS ARTICLE

IN other volumes of our book you learn the history of our land from the beginning, but there was so much to tell that we could not mention every event. Here you are given a list of the Presidents of the United States and are told the most important events which occurred during the term or terms of each of them. You will find it a very convenient storehouse of facts, though it is not so interesting as the story of the growth of our country. You will see that during some administrations everything was quiet and very few important events can be named. At other times, many things happened every year.

ADMINISTRATIONS OF THE PRESIDENTS

CONTINUED FROM 3224

GEORGE WASHINGTON, First President. (Two Terms, 1789-1797)

With the adoption of the Constitution and the organization of a Republic came the election of the first president of the United States, George Washington. He served two terms,—from 1789 to 1793 and from 1793 to 1797,—but refused a third term of office. His administrations were periods of growth for the new nation, and the wisdom of President Washington kept peace throughout the land. During his first term officers were appointed to carry on the new government, money was found to run it, the national debt was arranged, thus establishing the credit of the new nation, the Bank of the United States was opened, and we adopted the decimal money system of dollars, dimes and cents.

The prosperity of the country was greatly increased by the invention of the cotton gin by Eli Whitney; peace was secured by Jay's treaty with England, and by a treaty with Spain; and the number of states in the Union was increased to sixteen, by the addition of Vermont (1791), Kentucky (1792), and Tennessee (1796).

JOHN ADAMS, Federalist. Second President. (One Term, 1797-1801)

In 1797 John Adams, of Massachusetts, who had been vice-president under Washington, became president of the United States. During Washington's administration, the French had asked our assistance in their war against England, and now, in Adam's administration, the corrupt government of France threatened to fight us unless we bribed them with money, "plenty of money." A wave of indignation swept over the United States. Pinckney, our minister to France at that time, spoke for the nation: "Millions for defence," he said firmly, "but not one cent for tribute." Soon a short and irregular war opened between our country and France. The United States captured two or three French battleships, and several privateers, while our privateers took many French merchant ships. War was not declared, however.

Adams' administration was rather an unfortunate one for him, as, owing to the trouble occasioned by foreigners who tried to stir up American citizens to help them in their war against England, Congress passed new laws called the Alien and Sedition Acts, providing punishment for foreigners who were bent upon mischief, and for all persons who spoke or wrote against the government. These laws were short-lived, and although it was never necessary to put the first into effect, yet they made President Adams very unpopular. The Kentucky and Virginia legislatures adopted resolutions that the government had gone beyond its powers.

THOMAS JEFFERSON, Republican. Third President. (Two Terms, 1801-1809)

Though President Adams was a candidate for re-election, he was defeated by the candidate of the new Republican party, Thomas Jefferson, of Virginia, who had been vice-president. Jefferson and Aaron Burr received the same number of votes, but the former was chosen by the House of Representatives. He served for two terms, from 1801 to 1809.

His administration was an eventful one for our country. The pirates of Algiers and Tripoli, who for years had demanded tribute from our vessels, were completely subdued by our warships, so that we were troubled by them only once afterwards. In 1803 an immense tract of land, more than doubling the area of the United States, was obtained for us from France through the Louisiana Purchase, and was partly explored by Lewis and Clarke in 1804-1806. Louisiana then meant the country west of the Mississippi, which was drained by that river, and from it thirteen states have been made, wholly or in part. The price paid was $15,000,000. In 1807 the first successful steamship, invented by Robert Fulton, sailed up the Hudson River. Ohio was also admitted to the Union in 1803.

Great Britain was then at war with Napoleon, and each forbade us to send ships to the other. Jefferson had Congress pass the Embargo Act, in 1807, refusing to trade with any foreign country. This caused hard times in this country but did not make either party to the war agree to let our ships alone.

JAMES MADISON, Republican. Fourth President. (Two Terms, 1809-1817)

James Madison, also of Virginia, became president in 1809, and served two terms. Trouble with England and with Napoleon continued, and it was seen that war must come. Both had injured us, and some of our citizens wished to declare war on both. England had harmed us most, because she had more ships, and besides had stopped many American ships and taken off sailors, claiming that they were British subjects. Some of them were deserters from British ships, but others were naturalized citizens, or even American born. War was declared against Great Britain in June, 1812, and fighting soon began on land and sea.

Though the American navy was small, the ships were good, and several British ships were defeated in fair fight, as you can read in another part of our book, but the attempts to invade Canada were not successful, though York (now Toronto) was taken and burned. In revenge the British burned the public buildings in Washington. In a battle fought at New Orleans, January 8, 1815, after peace had been declared, but before the news had crossed the water, Andrew Jackson, with an army of backwoodsmen, defeated a force of British regulars. The treaty of peace had been signed at Ghent, December 24, 1814, but there were neither cables nor fast steamships then. The first Bank of the United States came to an end in 1811, and another was chartered in 1816. During Madison's administrations, two new states, Louisiana (1812) and Indiana (1816), were added to the Union.

JAMES MONROE, Fifth President. (Two Terms, 1817-1825)

Our fifth president, James Monroe, also from Virginia, had fought in the Revolution and had been sent to France to arrange the purchase of Louisiana. He came into office when the country was recovering from the War of 1812, and in the following years the young republic advanced by leaps and bounds. Florida was purchased from Spain and made a territory of the United States; five new states—Mississippi (1817), Illinois (1818), Alabama (1819), Maine (1820), and Missouri (1821)—were added to the Union; and the people poured over the Alleghanies into the rich bottom lands in the Mississippi Valley. The dispute over admitting Missouri as a slave state was settled by the Missouri Compromise.

The "Monroe Doctrine," forbidding the further colonization of the western hemisphere, or interference with the governments of the republics of South and Central America by European powers, also came into existence during this administration.

During Monroe's first administration party feeling died down, and no candidate opposed him at the election in 1820. One elector, however, refused to vote for him, saying that no man except Washington should receive every vote.

JOHN QUINCY ADAMS, Sixth President. (One Term, 1825-1829)

At the election of 1824 no candidate received a majority of the electoral votes and so it was the duty of the House of Repre-

sentatives to elect. John Quincy Adams, a son of the second president, was chosen, though Andrew Jackson had received more electoral votes. While Adams was president the Erie Canal from Albany, on the Hudson River, to Buffalo, on Lake Erie, was completed (1825), making travel to the West far cheaper and easier in every way. It also helped in building up cities and towns in the western part of New York State. President Adams and Congress could not agree and very few important laws were passed during his administration.

ANDREW JACKSON, Democrat. Seventh President. (Two Terms, 1829-1837)

Andrew Jackson, of Tennessee, was one of the best beloved presidents of the United States. He was elected in 1828 and served two terms of office. Not long after his inauguration a newspaper came into existence under the editorship of a young man named William Lloyd Garrison. It was called The Liberator, and was in favor of freedom for the slaves in the South. This was thought a wild idea at the time and created a great stir.

About this time South Carolina, under the leadership of John C. Calhoun, objected to a law passed by Congress increasing the tax on all cotton and woolen goods imported from abroad, as the Southerners said they could clothe their slaves much cheaper on imported material than on material sold by manufacturers in the North. The state declared that the law should not be enforced in that state. This was called Nullification. The people became so heated over the matter that war between South Carolina and the Union was only prevented by the firmness of President Jackson and by the wisdom of Henry Clay, who persuaded Congress to make the tax lighter.

The most of the Indians in the East were removed to lands across the Mississippi River, but in some cases resisted by force. President Jackson opposed the United States Bank and helped to destroy it. The surplus money in the treasury of the United States was distributed to the states. During General Jackson's administration two new states were added to the Union, Arkansas (1836) and Michigan (1837), making twenty-six in all, thus doubling the number of the original states. The first steam railroads began during this administration.

MARTIN VAN BUREN, Democrat. Eighth President. (One Term, 1837-1841)

In the election of 1836, Martin Van Buren, of New York, the vice-president, was chosen president. Shortly after his election, the wonderful progress of our young nation was interrupted for a space by hard times and money difficulties throughout the country. Immigrants began to come in from Europe, and the West developed very rapidly as more canals and railroads were built. There was a sharp little war with the Seminole Indians in Florida.

WILLIAM HENRY HARRISON, Whig, Ninth President, and **JOHN TYLER**, Tenth President. (One Term, 1841-1845)

President Van Buren served only one term and was followed by General Harrison, who had won the memorable victory over the Indians at Tippecanoe. His services had not been forgotten by the American people. With shouts and songs of "Tippecanoe and Tyler too," he was elected to the office of chief executive in 1840. But he lived only a few weeks after he took office, and John Tyler of Virginia, his vice-president, succeeded him in office. Times once more became prosperous under Tyler. The first telegraph instrument was invented by Professor Morse and a line constructed from Washington to Baltimore in 1844. Since then telegraph lines have been constructed over all the known world.

A treaty was made with Great Britain to settle the boundary between Maine and Canada. This was the Webster-Ashburton Treaty. Texas had declared its independence of Mexico and set up as a republic, but asked to be annexed to the United States. During the last months of Tyler's administration a treaty annexing Texas was signed, but it was not admitted as a state until Polk's administration. Florida, however, was admitted the day before Tyler went out of office.

JAMES K. POLK, Democrat. Eleventh President. (One Term, 1845-1849)

James K. Polk, of Tennessee, who served one term, came to this office in 1845, when the whole country was ringing with the cry "Give us Oregon, or we will fight," for Great Britain claimed a part of that region, and for a while the two nations nearly came to blows over the matter. Finally it was settled by an agreement dividing Pacific territory between them.

In that same year, 1846, we declared war with Mexico over a strip of land which both that country and the state of Texas claimed to own. Every battle fought in the war we gained, and when the war closed a large tract of land was given up by Mexico, including California, Utah, Nevada and parts of New Mexico, Arizona, Colorado and Wyoming. We paid $15,000,000 and afterward $10,000,000 more.

During Polk's administration three new states, Texas (1845), Iowa (1846), and Wisconsin (1848), joined the Union, making thirty states in all. Just before the War with Mexico closed, gold was discovered in California and there was a mad rush to the West, thus rapidly settling that part of the Pacific Coast.

ZACHARY TAYLOR, Whig, Twelfth President, and MILLARD FILLMORE, Whig, Thirteenth President. (One Term, 1849-1853)

In 1848 General Zachary Taylor, of Louisiana, was elected our twelfth president, and not long after his inauguration, California asked to come into the Union as a free state. The South, under the leadership of Calhoun, bitterly opposed this, wishing it to enter as a slave state. For some time Congress disputed the matter, but finally, after President Taylor had died, and Fillmore, his vice-president, had succeeded him, a plan of compromise proposed by Henry Clay was accepted, whereby in 1850 California was admitted as a free state, while nothing was said about slavery in the territory taken from Mexico; the slave trade was forbidden in the District of Columbia; also a new Fugitive Slave Law was passed by Congress enabling slave holders to catch their runaway slaves in the North. The famous book, Uncle Tom's Cabin, was published in 1852.

FRANKLIN PIERCE, Democrat. Fourteenth President. (One Term, 1853-1857)

Our fourteenth president, Franklin Pierce, of New Hampshire, was inaugurated in 1853, and during his term of office the dispute between the North and South upon the slavery question became more bitter than ever. Stephen A. Douglas, the wonderful orator of the West, persuaded Congress to make two territories of Kansas and Nebraska, giving them the right to choose whether they would have slaves or not. Immigrants to Kansas from the North wished to have it free; immigrants from the South determined to own slaves, and the result was that Kansas became a battlefield, with the two parties ready to fly at each other's throats on sight. So long and so disgraceful was the feud that the new territory became known as "Bleeding Kansas." Some territory known as the Gadsden Purchase was bought from Mexico and a treaty opening Japan to trade was also an important event.

JAMES BUCHANAN, Democrat. Fifteenth President. (One Term, 1857-1861)

With the coming of James Buchanan, of Pennsylvania, to the presidency in 1857, the discussion over slavery became more bitter. The Dred Scott Decision of the Supreme Court declared that negroes could not become citizens, and that Congress could not keep slavery out of the territories. Many states in the North refused to return runaway slaves and in fact helped to hide them and to send them to Canada. John Brown, who had been protesting against slavery in Kansas, made a raid upon Harper's Ferry, Virginia, captured the arsenal, and attempted to excite the slaves to rise and kill the whites. He was captured, tried and hanged by the state of Virginia.

Before President Buchanan's term was over, seven states had seceded from the Union, because a Republican president had been elected. President Buchanan did not think that states had a right to secede, but he did not think that he had a right to keep them in by force either.

Three states, Minnesota (1858), Oregon (1859), and Kansas (1861), were admitted to the Union during this administration.

ABRAHAM LINCOLN, Republican, Sixteenth President, and ANDREW JOHNSON, Republican, Seventeenth President. (Two Terms, 1861-1869)

In November, 1860, Abraham Lincoln, of Illinois, the Republican candidate, was elected the sixteenth president of the United States, and soon South Carolina seceded from the Union. Before Lincoln had been inaugurated Mississippi, Georgia, Florida, Alabama, Louisiana and Texas had followed her lead. When Lincoln came into office, in 1861, the country was ready for war, and action opened with the capture of Fort Sumter, April 14, 1861, by the Southerners. President Lincoln at once called for 75,000 men, and Virginia, Arkansas, Tennessee and North Carolina seceded.

The story of the war and of the freeing of the slaves, is told in another part of our book. The war was practically ended by the surrender of the army of General Robert E. Lee at Appomattox, April 9, 1865. A few days later (April 14) all were shocked to hear that the president had been fatally wounded by John Wilkes Booth. West Virginia (1863) and Nevada (1864) became states.

Vice-President Andrew Johnson, of Tennessee, at once became president. He was not a popular man and in 1868 a number of the members of Congress attempted to remove him from office, but they did not succeed. After enduring several years of bad government, some of the southern states were received back into the Union and were once more allowed to send members to Congress. The freed negroes also were given the right to vote. Some of the states were not received until the next administration. The Alaskan territory was purchased by us from Russia for $7,200,000, thus adding a vast area to the United States; and in the same year Nebraska entered the Union (1867).

ULYSSES S. GRANT, Republican. Eighteenth President. (Two Terms, 1869-1877)

When President Johnson's term expired he was replaced in the presidency by the man who had led the Union troops to victory during the Civil War, General Ulysses S. Grant, of Illinois. He was inaugurated in 1869, as the eighteenth president of the United States. While General Grant was president the first railroads running across the continent to the Pacific were completed, in 1869, and thousands traveled over their lines to settle in the great West. Other events of public interest during Grant's administration were serious Indian troubles, including the massacre of General Custer and his men; the panic of 1873, during which many banks stopped payment and many business houses failed; trouble with Spain over the Virginius, a ship flying the American flag, which was captured while on the way to Cuba with arms for the rebels; the admission of Colorado to the Union (1876); and the holding of a World's Fair at Philadelphia in 1876 to show the wonderful growth of our young nation during the first hundred years of its existence. This Centennial Exposition was a wonderful success and helped to make the people proud of their country.

RUTHERFORD B. HAYES, Republican. Nineteenth President. (One Term, 1877-1881)

The first disputed election for president in our history occurred in 1876. So close was the contest between Samuel J. Tilden, of New York, the Democratic candidate, and Rutherford B. Hayes, of Ohio, that a special body, known as the Electoral Commission, was appointed to settle the matter. It decided in favor of Mr. Hayes.

There were few events of national importance that occurred during the administration of our nineteenth president. The United States troops, which had been kept in the South after the war, were withdrawn. The white people had already gained the power in most of the southern states, and after the troops were removed they gained control in all. The Mississippi River was made deeper at its broad mouth. This was of great advantage to the city of New Orleans, as it now enabled vessels to pass in and out of the river without trouble, and thus greatly assisted commerce.

JAMES A. GARFIELD, Republican, Twentieth President, and **CHESTER A. ARTHUR**, Twenty-First President. (One Term, 1881-1885)

We now come to James A. Garfield, of Ohio, who was elected in 1880. He had been in office but a few months when a man to whom he had refused to give a position in the government, shot him down in the railway station at Washington. Two months later he died and Vice-President Arthur became our twenty-first president. The terrible death of President Garfield turned the attention of the people to the regulation of government positions, and a law was passed taking many appointments out of the hands of the chief executive and compelling those trying to get government work to pass an examination first, thus protecting the president from private requests for places. President Arthur's administration, coming as it did some years after the Civil War, was one of great prosperity. Cotton industries, manufactures of all kinds and the opening of great iron mines throughout the country were among the "signs of the times." An exposition held in New Orleans, in 1884, showed the great progress of the South. Postage on letters was reduced from three cents to two cents in 1883. More immigrants than ever before entered the country.

GROVER CLEVELAND, Democrat. Twenty-Second President. (One Term, 1885-1889)

Grover Cleveland, of New York, came to the presidency in 1885, as the twenty-second president. Several laws of importance were passed during his administration. An act establishing the Interstate Commerce Commission was passed. This body was given the right to study the rates charged by the railroads. Other acts were one regulating the counting of votes in the election of a president and another providing for the filling of the presidential chair in case of the death of both the president and vice-president. In 1886 the beautiful Statue of Liberty in New York Harbor was presented to the country by the French in token of the good will they felt toward our nation. Any night it may be seen, its flaming electric torch on high, guiding vessels coming up the harbor to the great metropolis of the "land of religious and personal freedom." A severe earthquake which did much damage in the South occurred in 1886.

BENJAMIN HARRISON, Republican. Twenty-Third President. (One Term, 1889-1893)

With the administration of Benjamin Harrison, of Indiana, the territory of Oklahoma was opened to white settlers in 1889. During 1889 Montana, Washington, North and South Dakota entered the Union, and Idaho and Wyoming were admitted the next year. It was decided that we should enlarge our navy, so the United States began to build a number of steel warships. Serious labor troubles also caused much loss of life. The tariff rates were raised, and pensions to soldiers of the Civil War were increased.

GROVER CLEVELAND, Democrat. (One Term, 1893-1897)

In 1892, Grover Cleveland was again elected president. He is the only president who has served two terms not in succession. In 1893, a great World's Fair was opened in Chicago to celebrate the discovery of America by Columbus four hundred and one years before. Hard times came in 1893, and there were many business troubles. The tariff was reduced. In 1895, a dispute arose between England and the United States regarding the boundary between Venezuela and British Guiana, and for a time war was threatened. The matter was, however, referred to arbitration; that is, wise men were appointed to decide the matter, and there was no war. Before Cleveland retired from office another state, Utah, was added to the Union in 1896, so that the stars in our flag now numbered forty-five.

WILLIAM McKINLEY, Republican, Twenty-Fourth President, and **THEODORE ROOSEVELT,** Republican, Twenty-Fifth President. (Two Terms, 1897-1905)

William McKinley, of Ohio, was chosen president over William J. Bryan, of Nebraska, at the election of 1896. During his administration the country was again plunged into war. Spain had been treating the people in Cuba in a most heartless way, and in consequence a war broke out between Spain and her possession. So many Cubans died a terrible death from starvation, the United States stepped in and said that Spain should not oppress her colony. We sent the battleship Maine down to Havana to inquire into the conditions. While lying in the harbor of that city she was blown up and many of her officers and sailors were killed. The Spaniards were suspected of the act. President McKinley at once said that the war in Cuba must stop, and Congress declared the people of Cuba free and independent, telling Spain to remove her soldiers from that territory. Spain refused and war opened between Spain and the United States.

After a few months the war came to an end by Spain giving Cuba her freedom and selling the Philippines, Porto Rico and another small island to the United States for $20,000,000.

Before the end of the war with Spain, we also came into possession of the Hawaiian Islands. The country became prosperous and plans were made to water the dry lands of the West. But in this time of our growing prosperity, President McKinley was assassinated soon after the beginning of his second term, and Vice-President Roosevelt, of New York, became the twenty-fifth president of the United States in 1901.

In President Roosevelt's first administration the United States bought the rights of the French in the Panama Canal, a right for which we paid $40,000,000. The new Republic of Panama was recognized, and a treaty allowing the United States to dig the canal was made. Work was begun to make the Isthmus safe for white men to work in. The great World's

Exhibition was opened at St. Louis on April 30, 1904, to celebrate the purchase of the Louisiana Territory by President Jefferson.

THEODORE ROOSEVELT, Republican. Twenty-Fifth President. (One Term, 1905-1909)

President Roosevelt was elected in 1904 after serving as president for more than three years of the term for which President McKinley had been chosen. During this term great progress was made in the government of our colonial dependencies, and a war against the waste of our natural resources was declared. You will hear a great deal more about the "conservation of natural resources" in the future.

San Francisco, California, was seriously damaged by an earthquake and the fire which followed in April, 1906. On account of disorder in Cuba, the United States took charge of the government until order was restored. Oklahoma was admitted to the Union in 1907. At the end of his term President Roosevelt sailed to Africa and spent over a year shooting big game and collecting specimens for the Smithsonian Institute.

WILLIAM H. TAFT, Republican. Twenty-Sixth President. (One Term, 1909-1913)

At the election of 1908, William H. Taft, of Ohio, who had been the first governor of the Philippines and had served as Secretary of War in President Roosevelt's Cabinet, was chosen. On the whole, his administration was uneventful. Work on the Panama Canal proceeded rapidly, but a revision of the tariff caused great dissatisfaction. New Mexico was admitted as a state in 1911, and the next year Arizona came into the Union. All the territory of the United States proper is now divided into states.

An amendment to the Constitution which made an income tax legal was ratified. In 1912, ex-President Roosevelt opposed President Taft for the Republican nomination, and, when defeated, became the candidate of the new Progressive party. The result was a Democratic victory.

WOODROW WILSON, Democrat, Twenty-Seventh President. (Two Terms, 1913—)

At the time of his election, President Wilson was Governor of New Jersey, and previously had been president of Princeton University. The new administration at once revised the tariff and the currency laws. A great exposition at San Francisco to celebrate the opening of the Panama Canal was held in 1915. An amendment making United States senators elective by the people instead of by the legislatures became a part of the Constitution in 1913. Trouble with Mexico arose over the ill-treatment of American citizens by bandits, and we came very close to war. In fact American troops invaded Mexico, and the Navy took the port of Vera Cruz. There was no regular government in Mexico at the time, but when affairs became quieter the forces were withdrawn.

At the end of President Wilson's first term the candidate of the Republican and Progressive parties was Justice Charles E. Hughes, of the Supreme Court. The election was very close, but President Wilson was re-elected. The Great War in Europe had its effect upon the United States from the first. When German submarines began to sink ships without warning and destroy American lives, President Wilson protested, and, for a time, the practice was stopped.

Early in 1917 the German government announced that any ships approaching certain parts of Europe would be sunk without warning. President Wilson dismissed the German Ambassador, and warned the German government that the sinking of another American ship would lead to war. American ships were sunk and Congress declared war on April 6, 1917.

Congress also voted to enlarge both the army and the navy. Many new ships were ordered, and the regular army and the national guard were greatly increased. In addition, a selective draft was made from all the men between twenty-one and thirty-one years of age, and more than half a million of them were soon drilling. Much money was raised for the Red Cross, and for the Y. M. C. A., the Knights of Columbus and other organizations which look out for the welfare of the soldiers. All American farmers were urged to raise more food, and every one was asked to save as much as possible for our army and our allies. Heavy taxes were levied, and the government borrowed much money by issuing Liberty Bonds.

American warships were soon in European waters, and American soldiers were in the trenches before the end of October.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 3625.

THUMBELINE FLOATED DOWN THE STREAM

Thumbeline became happy again, for everything she passed was lovely in the sunshine, and the birds on the branches sang to her as she floated by with her pretty butterfly tied to the water-lily leaf with her sash.

LITTLE TINY THUMBELINE

CONTINUED FROM 3374

ONCE upon a time there lived a young wife who longed to possess a little child, so she went to a fairy and said to her: "I wish very much to have a child, a little tiny child. Will you give me one, dear fairy?"

"With all my heart," replied the fairy. "Sow this barleycorn in a flowerpot, and then see what will happen."

"Thank you, thank you!" cried the woman, giving the fairy a silver coin. Then home she went, and planted the barleycorn, and immediately there shot up a large flower like a tulip, but with the petals tightly closed like a bud.

"What a lovely flower!" said she, and kissed it. The bud opened at once with a loud voice, and there, in the centre of the flower, sat a little tiny girl about an inch high, scarcely bigger than her thumb. So she called her Thumbeline, and put her to bed in a walnut-shell, with violet-leaves for her mattress and a rose-leaf for a quilt. During the day she told Thumbeline stories, and taught her to sing, as she played on the table beside her.

But one night a great, wet, ugly toad came and stole away the cradle with little Thumbeline asleep in it, and carried it off to her home in the muddy bank of the brook that flowed past the end of the garden.

"This is just the wife for my son," thought she. But when her ugly son saw her, all he could say was "Croak, croak, croak!"

"Don't make so much noise, or you'll wake her," said the old Mother Toad. "She may easily escape, for she is as light as a feather. We must take her out and place her on one of the large water-lily leaves in the middle of the brook, while I prepare our house for you both."

This they did, and when poor little Thumbeline awoke and found herself in the middle of the stream, she cried most bitterly.

As soon as old Mother Toad had decorated her home with bulrushes and yellow buttercups, she and her hideous son swam out to the leaf to fetch the cradle so as to place it in their new home before taking the little maid herself there.

Old Mother Toad bowed low in the water, and said: "Here is my son, who is going to be your husband. I shall come for you soon, and you will be very happy together."

Then they swam off with the cradle, and poor, terrified Thumbeline wept bitterly. Now, some little fishes had overheard old Mother Toad, and when they saw the little maid so sad they gnawed away the stem of the leaf, and away it floated down the stream, so fast that the toad could not catch it. Thumbeline became happy again,

for everything she passed was lovely in the sunshine, and the birds on the branches sang to her as she floated by. A pretty little butterfly hovered round her, and at last settled for a moment on the leaf, for he loved her very much. She was pleased, too, and tied him to the leaf with her sash.

But presently a great ugly cockchafer came buzzing past. He caught sight of her, and snatching her off the leaf, flew up with her into a tree; but the poor butterfly could not free himself, and went floating along downstream. The cockchafer gave Thumbeline some honey to eat, and praised her beauty; but when the henchafers saw her, they said that she was just like a human being.

"How very, very ugly she is!" they all cried; and at last the cockchafer disowned her, and they all flew down and set her on a daisy. Then she wept because she was so ugly that the henchafers would have nothing to do with her.

All the summer Thumbeline lived alone in a wood, dining off the honey from the flowers, and drinking the dew that every morning spangled the leaves around her. But then came the cold, cold winter; the flowers all died, the birds flew away, and the snow began to fall. Poor hungry Thumbeline wandered through the stubble of a grainfield hard by until she came to the hole of a field-mouse, who lived snugly down in the ground, having a room full of wheat, and a neat kitchen and store-room.

Thumbeline stood at the door and begged for food.

"Poor little thing!" said the good-natured field-mouse. "Come into my warm room and dine with me." And she soon became so fond of the tiny maid that she said: "You may dwell with me all the winter, if you will only keep my room clean and neat, and tell me stories, for I love stories dearly." And Thumbeline agreed, and was very happy in her new home.

In a few days' time the field-mouse said: "We shall have my next-door neighbor, the mole, in to visit us to-morrow; he comes to see me once a week. He is richer than I am, has large rooms in his house, and wears a beautiful black velvet coat. It would be capital if you married him; but he is blind, and cannot see you, so you must tell him your prettiest stories."

When he came, Thumbeline sang to him, and he soon fell in love with her. He invited them to his house, and led them down a dark passage that he had just burrowed from their house to his, lighting them with a piece of tinder.

But when they had gone a short distance they found a swallow lying stretched on the floor; the poor bird had evidently died of cold. Thumbeline felt very sorry, for she loved all the birds, but the mole kicked it, saying:

"Here's a fine end to all its whistling! What a miserable thing it must be to be born a bird! None of my children will be birds, thank goodness!"

But Thumbeline could not sleep that night, so she got up, and wove a carpet out of dried grass, and went and spread it underneath the bird and covered him with warm, soft cotton.

"Farewell, dear bird," said she; "farewell, and thank you for your beautiful song in the summer, when all the trees were green and the sun shone so warmly upon us." As she spoke she pressed her head against his soft body, and to her great surprise she felt his heart beat weakly. The bird was not really dead. Joyfully she tucked the cotton closely round him with her little hands, and as he felt the warmth, he gradually revived.

He lived underground all winter, and Thumbeline was kind to him and brought him water and food; but she never said a word either to the mole or the field-mouse.

As soon as the spring came the swallow said farewell to Thumbeline, who would not go with him, because she knew it would sadden the old field-mouse if she left her.

Thumbeline was now sorrowful indeed, for she was not allowed to go into the warm sunshine.

"This summer you must work and make your wedding clothes," said the field-mouse, for the blind, dull mole had decided to marry Thumbeline.

So the tiny maid was obliged to work hard at the distaff, and the field-mouse hired four spiders to spin and weave.

Every evening the mole came and talked about how the summer was coming to an end, and he abused the sun and pretty flowers so much that Thumbeline disliked him more and more, and said she would not marry him.

"Fiddlestick!" cried the field-mouse. "Don't be obstinate, child, or I will bite you with my white teeth."

At last the day fixed for the wedding had arrived, and Thumbeline went to bid farewell to the beautiful sun before going to dwell with the mole deep down in the earth.

"Farewell, bright sun!" she cried, and as she turned back into the gloom, her tears fell fast.

"Tweet, tweet!" And she heard a fluttering of wings, and there was the little swallow.

Near a calm, blue lake stood a half-ruined palace of white marble, and here the swallow had built her nest.

"This is my house," she said, "but I will take you to the garden of flowers that grows beneath us, and you shall make your home there."

But what was Thumbeline's surprise when she saw, sitting on a flower, a tiny little manniken, no bigger than herself. On his head he wore a bright gold crown, and from his shoulders grew a pair of delicate gauzy wings. He was the spirit of the flowers; in every flower in the garden

ALL THE FAIRIES CAME OUT AND BROUGHT THUMBELINE GIFTS.

there lived a fairy, and he was their king.

"The cold winter will soon be here again," said the swallow. "Let me save you, and take you to a land of sunshine. Come with me, sweet little Thumbeline. You saved my life when I lay frozen in the dark earth."

"Yes, I will go with you," she said; and she seated herself on the bird's back, and then the swallow soared high into the air and flew away over forest, lake, and mountain, until they reached a warm, sunny land. There the sky seemed twice as high and twice as blue, and there grew the loveliest green and purple grapes, and citrons, and melons.

When he saw Thumbeline he was delighted, for he had never seen so lovely a maiden. He asked her to be his queen, and when Thumbeline said "Yes," he took his crown and placed it on her head. Then all the fairies brought her gifts, and best of all was a pair of shimmering wings, for with these she could fly from flower to flower. "I shall not call you Thumbeline," said the fairy king; "you are too sweet and gentle for such an ugly name. My name for you shall be Maia."

And she dwelt with him in great happiness ever after.

HOW NAPOLEON RODE FROM WATERLOO

THE story is told that, at one moment during the battle of Waterloo, while the Duke of Wellington rode in front of his brave soldiers at Waterloo, saying, "Stand firm, my lads!" or "Hard pounding this, gentlemen; we will see who can pound the longest!" on the opposite side of the terrible battlefield Napoleon sat at a table, his feet buried in straw, his arms resting on the papers before him, his head nodding, his eyes heavy.

What a tragic figure! The great emperor, the terror of the world, in the midst of a frightful battle which would decide the fate of Europe—stunned with ruin, crushed by the certainty of doom. Can you think of anything more strange and sad?

Think of the huge cannons roaring in a great circle of fire and smoke; think of squadrons of horsemen thundering across the plain with sabres raised and shouting their battle-cries; think of long lines of foot-soldiers standing steadfast behind their bayonets, while behind them and over their shoulders the second lines fire, and fire again, at the approaching enemy! Think of the clamor, the noise of cannon and musket, the shouting of men, the screaming of horses, and the thud of galloping hoofs. Think of the movement—the rush of cavalry, the wheeling double of infantry, the terrific shock when two bodies of troops clashed together in hand-to-hand fight! Think of all these things! And then picture with your mind's eye a map-strewn table in the open air, and at that table the great general in his grey coat and his long riding-boots, with nodding head and heavy eyes, stunned by defeat.

And when at last he saw that the battle was lost, it was not with haggard, staring eyes of terror that he raised himself to see the truth, but still with dazed and clouded eyes like a man in a stupor. That wonderful flicker of his mind which we read about at Elba had lasted a hundred days. It was quenched at Waterloo. From that moment the great Napoleon admitted defeat. He stepped off the field of Waterloo into the carriage that was waiting for him. And all about him the torn and bleeding remnants of his shattered army were flying from the enemy. Bodies of galloping horsemen, bodies of running infantry, bodies of sweating artillery toiling at their cannon; a multitude of human wreckage, gasping, stumbling, and groaning, the torn and shredded banners staggering in the air, the knotted bandages round the heads of bearded warriors showing white against the steel-colored sky—a great host stricken by a panic.

Napoleon saw all this through his dazed and clouded eyes.

At Genappe, the Prussians were following so closely that he left his carriage for a horse, and in so doing, it is said, he had to defend himself with his pistols. Scarcely had he quitted his seat when the vehicle with its horses fell into the hands of the pursuers, and so great was his haste to get away, that he left in his carriage his hat and sword.

"What shall I do?" he asked, as they rode through the night.

"Ride to Paris," was the answer.

So he rode on, outstripping his army, and at four o'clock in the morning he reached Paris, and went to his palace. All he could do when he arrived there was to tramp up and down the big, gilded chambers, his heart weighed down with grief.

He knew that he was beaten. The French had no time to rally, owing to the rapid advance of the allies. Napoleon himself was not the great man he was at the battle of Maringo and Austerlitz, and though he was not entirely broken down, his health was very much impaired.

His army had failed in the gigantic task it had attempted, and Napoleon was forced to abdicate. Twice before, he had returned to Paris with a defeated army. This was the third time, and Paris could forgive no longer. They gave him an hour! Think of it! He who had given them an empire, he who had received from them a throne, was given an hour to decide his fate! He surrendered his throne.

For a few weeks he waited, hoping his soldiers would call him back, and then on July 14, he rode out of Paris for the last time and gave himself up to a British ship.

NAPOLEON FLIES FROM HIS FIELD OF DOOM, TO CARRY THE NEWS OF HIS FALL TO PARIS

After the defeat of his army and the ruin of all his hopes at Waterloo, Napoleon fled from the battlefield in a carriage. The Prussians were following so closely that he had to leave his carriage for a horse, and scarcely had he quitted his seat when the vehicle with its horses fell into the hands of the pursuers. In his haste he left his hat in the carriage.

This striking picture of a great scene in history is from the painting by Mr. Ernest Crofts, R.A., which now hangs in the Walker Art Gallery, Liverpool.

THE STORY OF BEOWULF

LONG ago the Saxons used to sing, at their feasts, songs about a favorite hero, Beowulf, a nephew of Hygelac, King of the Geats. When the Saxons left their home on the continent and went to Britain they did not forget the songs. From time to time, more and more tales of brave deeds were added, and after a while these incidents were woven together into one long story, like that of King Arthur. Here it is:

The old king, Hrothgar, who ruled over the Danes, built a beautiful banquet-hall where he entertained his friends. As it was adorned with horns of deer, he named it Heorot, or Hart Hall. Every one admired it, but one night a wicked monster, Grendel, who was jealous of the feasters and merrymakers, came from his den in the marshes, and crept up to the hall where the knights lay asleep, and slew thirty of the men, dragging their bodies away to be devoured.

Grendel was a hideous sea-monster, half man and half beast, and covered with a green horny skin. His teeth were long and sharp, like the tusks of an animal, and his huge body and great hairy arms had the strength of ten men. His hide was so hard that no sword could pierce it, his nails were sharper than daggers, and at his side hung a great bag, in which he could carry off those whom he was ready to devour.

Night after night, for twelve long years, the ogre visited the hall, and captured the king's men. Hrothgar was very sad, until he learned that help was coming. The young Danish champion, Beowulf, had heard of the king's trouble, and hastened from his home in the south of Sweden to help him. When he arrived with fourteen of his comrades, the king prepared a great feast, and at its close permitted Beowulf and his men to remain in the hall.

The comrades lay down in all their armor, but Beowulf took off his coat of mail wrought with shining rings of steel, unbelted his sword, and removed his helmet. For, as he said to his men, "I will strive against this fiend weaponless. With no armor—since he wears none—will I wrestle with him. I will conquer, if I win, by my hand-grip alone, and the all-wise God shall judge between us, and grant the victory to whom He will."

During the night, while the warriors are asleep, Grendel breaks down the iron-barred doors, enters, and pounces upon one of the men. He seizes him with his scaly hand, crunches his bones, and swallows great pieces of his flesh. In a twinkling he devours all, even the hands and feet. His eye shines like fire as he reaches out to seize another man. Beowulf catches him and struggles with the beast. The ogre tries to free himself with a mighty jerk, but his arm is torn from the shoulder and is held in the iron grasp of Beowulf. Grendel escapes, though badly wounded. Beowulf, victorious, proudly exhibits the huge arm which he has wrenched from the monster, and hangs it in the banquet hall.

Hrothgar is happy to hear the news and heaps costly treasures upon the hero, and decrees a great feast for him. After the banquet, Hrothgar escorts his guests to his palace, leaving his own men to guard Heorot, for all are sure that Grendel is too badly wounded to return. But, while all are asleep, Grendel's mother, a terrible Water Witch, enters the hall, secures her son's arm, which hangs as a trophy on the wall, and seizes Aschere, one of the king's favorite thanes, and bears him away to the fens.

Beowulf, hearing of this ghastly deed, starts out to avenge Aschere, by attacking Grendel's mother in her own retreat. With his band of warriors he follows the tracks of the demon, until they reach the pool, where they find Aschere's head hanging as a trophy. Looking down into the waters, Beowulf sees the blood-stained trace of the monster, but nevertheless he bravely plunges into the water, and guided by a bright gleam reaches the cave. As he nears the den, a strong current sweeps him within reach of Grendel's mother, who seizes him with her horrible claws, and stabs at him with a broad knife, but his armor protects him from her thrusts. He snatches a huge magic sword which he spies hanging on the rocks, swings it fiercely around his head, and strikes so furiously that the great steel blade passes clear through the beast's neck. The monster falls headless to the ground. Then Beowulf rushes to the rear of the cave, and finding Grendel's body, cuts off his head, and swims through the tainted waters to the shore,

with Grendel's head in one hand, and the giant's sword in the other.

The hero is brought in triumph to Hart Hall, where he presents the trophy to the king, and tells the thrilling tale of his encounter. Hrothgar places Grendel's head upon a spear-shaft in his great hall, and praises Beowulf for his work, and gives him many gifts. After a banquet, Beowulf and his followers make preparations to go back to their own land. His task completed, Beowulf sets sail and returns to his home, where he is welcomed by Hygelac in his palace by the sea. He relates his adventures, and delivers messages of friendship from Hrothgar, and presents the great war-sword, the gray mail-coat and the helmet to the king. Hygelac in turn presents him with a gold-decked sword, pieces of gold, a beautiful palace, and honors him with a chieftain's rank.

After a time, Hygelac is slain in battle, and Heardred, his son, reigns for a while, but he too is killed in war, and then Beowulf succeeds him as king. His fame as a warrior protects his country from invasion, and his wisdom increases their prosperity. For fifty years, Beowulf reigns over his people, and all goes well until the country is suddenly disturbed by the ravages of a dragon, a monstrous fire-breathing fiend, which lives in a den near the sea, gloating over a mound of treasure hidden there.

One night a hunted fugitive enters the dragon's cave, notices the fire-drake sound asleep and sees his immense hoard which he has guarded for hundreds of years. Greatly frightened, the fugitive seizes a beautiful golden cup and carries it away. When the dragon awakes and discovers his loss he becomes enraged, and hurries over the land, hunting for the thief. Every night the monster appears, lighting up the darkness with his flaming breath, burning houses, men and cattle, with the flames from his mouth.

One day the beast burns the royal castle to the ground, and sets fire to many homesteads. Although old age has deprived him of some of his great strength, yet Beowulf resolves to slay the dragon and protect his people. Knowing that this may be his last encounter, he addresses his friends in a farewell speech.

"In my youth," said the king, "I fought many battles, and yet once more will I, the aged guardian of my people, go forth to contest, and battle with the dragon. I shall win the gold by my valor, or battle shall destroy your lord."

Then clad in heavy armor with a fire-proof shield of iron upon his arm, the old king sets out for the mountain-gorge to meet the fiery dragon. With a shout he challenges the dragon to come forth. An instant later the giant rushes out, breathing flames, and attacks the warrior. As Beowulf defends himself, his great sword is broken in pieces. Wiglaf, one of Beowulf's trusted followers, seeing his lord suffering in the deadly heat, springs forward to aid him, but Beowulf draws his dagger, stabs and slays the beast.

Poor Beowulf is so badly wounded that he feels his end is near. He speaks to his followers: "Now would I give battle-raiment to my successor. Fifty years have I ruled my people, and not one of the kings living around dared oppress me with terror, or attack me with weapons. Great deeds have I done with sword and with hand-grip."

Turning to Wiglaf, he said, "Go quickly, dear Wiglaf, to view the hoard under the hoary rock. The dragon lies dead, bereft of his treasure. Be in haste that I may see the gold and look upon the bright gems. Then may I the more easily give up my life and kingship, which I have long held."

Wiglaf hastens to obey his wounded lord, and brings the treasures from the cave. The old warrior is about to die, but he raises his head to admire the gold and jewels, helmets, beakers and silver vessels. Then, taking from his neck the golden collar, he gives it to Wiglaf, together with his helmet and armor.

"Thou art the last of our race," he said. "Fate has swept away all my kinsmen at the appointed time. Now must I too follow them." Then he orders his ashes to be placed in a great mound, high on a cliff, "so that the seafarers driving their tall ships over the ocean may in time call it by the name of Beowulf's mound."

The body of the monster is pushed over the cliff into the sea, a funeral pyre is built, all hung with helmets and battle-shields, and on it is placed the body of their dead leader. Afterward they build a great mound by the sea, and in it bury rings of gold and other treasure from the cave of the fire-breathing dragon.

THE FABLES OF ÆSOP THE SLAVE

THE GOAT AND THE LION

A LION one day saw a goat upon a steep, craggy rock, where he could not climb up to him, so he said: "What pleasure can you possibly find in jumping from one rock to another all day, and risking your neck every moment? I wonder that you do not come down here and feed in the meadow, where there is plenty of fresh, sweet grass."

"Well," replied the goat, "what you say may be very true; but, to tell you

the truth, you look so uncommonly hungry and fierce that I do not care to take the risk and venture too near you."

Beware of the advice of people who want to gain something from you.

THE CROW AND THE PITCHER

A CROW, almost dying with thirst, found a pitcher, or tall jug, which

had a little water in the bottom. Unfortunately, the crow was not able to reach the water. Again and again he tried, but without success. Then he tried to knock the pitcher over, so that he might get at the water; but he was not strong enough for this.

At last he noticed a quantity of little pebbles lying about. After much trouble and labor he gathered these together, and, dropping them into the pitcher one by one, he at last raised the water up to the brim, and so was able to drink.

Where there's a will there's a way.

THE TWO FROGS

ONE hot summer, when the country was parched and the lakes and ponds had nearly all dried up, two frogs

were traveling together in search of water. At last they came to a deep well, and, sitting upon the edge of it, began to discuss whether they should jump in. One of them was in favor of doing so, urging that there was plenty of clear water and no danger of being disturbed; but the other thought for some time, and then answered: "That is all very well; but I do not care to jump in, because if the water should happen to dry up here, how shall we get out again?"

Always look before you leap.

THE LION AND THE FOUR BULLS

FOUR bulls who were great friends always kept near one another and fed together. A lion had often watched them, and wanted to kill one for his dinner. But he was afraid to attack all four together, knowing that they would defend one another. So he began by telling one of the bulls stories about the others to arouse jealousy and bad feeling among them.

The result was that the four bulls quarreled and no longer went about in company. They separated and roamed

alone. Then the artful lion was able to kill and devour the bulls one at a time.

Remember that union is strength.

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WHERE DOES THE RAIN GO?

CONTINUED FROM 3391

MANY things happen to the rain that sinks in the earth, and exactly what happens depends largely on what the surface of the earth is like at that particular place. A great deal of the rain remains in the soil to the depth of some feet, as soil water or ground water. If there is no such water there can be no vegetable life. But in places where rain falls, and the ground holds some of it, there we are sure to find plants of various kinds, that suck up a good deal of this water into themselves by their roots, and then give it back to the air. The soil also contains all sorts of life of other kinds besides green plants, such as various kinds of animals, like worms and insects, and also countless numbers of microbes. All these take up and use for their lives some of the water that the rain gives to the soil.

But still a great deal of the rain is not used up in any of these ways. Much of it is drawn again into the air by the sun's heat, when the rain stops falling. Much of it also goes on sinking slowly through the earth until it reaches a layer of something through which it cannot sink. It may be carried on this layer to some lower level, where it may bubble up out of the ground as what we call a spring. In the long run almost all the rain that is not kept by living things, or given back to the air at once, gets into streams and rivers, and into the sea, where the sun sucks it up to go on its round again.

WHERE DID ALL THE WATER IN THE OCEANS COME FROM?

We might at first think, if we remember how all the rivers run into the oceans, that rivers bring the water. But, after all, just as much water as the rivers bring is caught up by the sun into the air; and the amount of water in the sea is, in any case, too great for the rivers to account for. By far the greater part of the water in the oceans is what we may call the original water of the world, which has gathered in the ocean-beds, because they are the most convenient places for it to be, under the influence of the earth's gravitation. The water, as we know, was long ago held in the air when the air was much hotter than it is now. But, of course, it is right for us to ask where it came from even before it fell upon the earth and helped to form the oceans. The answer is that it was made ages ago by the burning of hydrogen with oxygen. Elements cannot combine with each other in intense heat, and so before the water of the world was

formed it was very hot, and hydrogen existed separately, though there was plenty of oxygen near it. As the earth cooled a little, however, it became possible for hydrogen and oxygen to combine, which they did, forming water. There is a great deal more oxygen than hydrogen in the world, as we know, and most of the oxygen which was left over when the hydrogen was burned up to form water is to be found in the atmosphere still.

HOW IS IT THAT THE WATER OF THE SEA DOES NOT SINK INTO THE GROUND?

Whenever it can, water does sink into the ground; and where the sea is deep, the pressure of all the water above will force the water at the bottom into the ground if it can possibly go there. It is probable that in most places the ground of the sea is of a very dense kind which water cannot penetrate as a rule; but often things may happen to it that will allow some water to pass through, and then, when that water reaches the hot levels of the earth's crust, it is turned into steam, and may make a great disturbance. We always think of earthquakes as things that happen on the dry land, but we know that earthquakes also occur in the bed of the sea. When a very powerful earthquake occurs in the bed of the sea, and a great deal of water sinks in and is turned into steam, we get what may be called a seaquake, and there is little doubt that some of the strange and terrible things which the sea does are caused in this way.

But we must suppose that, on the whole, the bed of the sea is not so easily penetrated by water as many parts of the dry land are, and that is perhaps one reason why it has become the bed of the sea. Instead of letting the water run through it, it holds the water upon the top of it, as the bottom of a basin does, and then the weight of the water gradually helps to force it down and make it cup-shaped, so that it will hold still more water. But we cannot be at all sure about this, for it is a very difficult thing indeed to find out.

WHAT IS IT LIKE AT THE BOTTOM OF THE SEA?

No man has ever been to the greatest depths of the sea, for even if it were possible to send air down to him, the pressure of water above his head would be far too great for him to stand. But we can get some idea of what it must be at the bottom of the deepest parts of the sea, for we know the kind of things that live there, and we know something of the conditions of their lives. Six, five, or even three miles below the level of the sea there cannot be very much light, and though it cannot be perfectly dark, yet it is what any of us would call quite dark. Here there lives a strange medley of creatures—strange fishes and sea-weeds. Down to them, from above, there descend the remains of all sorts of other sea creatures that live in the heights of water above them.

If we remember that the sea covers something like five-sevenths of the whole earth, we shall see that, of the total amount of life upon the earth, a very large proportion is to be found at the bottom of the sea. It is life of a very humble kind for at least two reasons. One is the immense pressure of the water above it, which prevents the development of higher forms of life; the other reason, that has the same result, is the very small quantity of oxygen that is available for the purpose of life at the bottom of the sea. This means, of course, that the life of these creatures must be lived very slowly, and is indeed very different from the life of creatures that have air to breathe, or even a fish that lives in a stream which has plenty of oxygen dissolved in the water all around it.

WHY DOES A BOTTLE FULL OF HOT WATER KEEP HOT LONGER THAN ONE HALF FULL?

The answer to this is that the bottle full of hot water contains more heat than the bottle which is only half full. Water is a wonderful storehouse of heat. Different things require different amounts of heat to be put in them in order to be raised to the same temperature. We might think this should not be so, but it is. If you take a certain quantity of water at any fixed temperature you please, and then the same quantity of anything else in the world, and then make them both, say, five degrees hotter than they were before, you will find that you have to put more heat into the water than into the other thing; and just as it takes longer to heat water than to heat anything else, because you have to put more heat into it, so water takes longer to cool than anything else, because it

has more heat in it to lose; and, of course, the greater the quantity of water, the more heat it has within it.

But there is another point to remember; the bigger the mass of anything is, the longer it takes to cool. A thing cools from its surface inwards; the parts inside it keep each other warm. The smaller the mass of a thing, the bigger is the proportion of its surface to the amount of stuff in it, and so the quicker it cools. So that the case of the hot-water bottles, the different rates at which the sun, the earth, and the moon become cool, and the fact that a baby requires to be more warmly clothed than a man, are all explained by the same law.

WHERE DOES THE OXYGEN IN THE SUN COME FROM IF THERE ARE NO PLANTS?

It is rather difficult for us to understand, but we must remember that a thing may be intensely hot and glowing and flaming without any burning, combustion, or combining with oxygen going on. The thread inside an ordinary electric lamp is an instance of this. Now, long ago, astronomers thought that the sun's heat and flames were due to burning going on in the sun, just as it goes on in a fire on the earth; but then they came to ask themselves practically just the question we are asking: "If the sun's heat and light are due to combustion, where does all the oxygen come from, and where does all the fuel come from?" If the sun were burning as a fire is burning, it would have burned itself out millions of years ago. There is nothing like enough material in the sun to account for all the light and heat it produces. Therefore, burning, combustion, or combining with oxygen has nothing to do at all with producing the sun's heat and light, any more than with producing the heat and light of an electric lamp. The sun's supply of heat is kept up in other ways, partly by his ceaseless shrinking, and partly, we suppose, by the breaking up of the atoms of elements, such as radium, in the sun.

IF THE EARTH'S CENTRE IS A BALL OF FIRE, WHY DOES IT NOT BURN UP EVERYTHING?

When we say burn or consume, we mean combine with oxygen. So, if there is no oxygen in a place, burning cannot go on. The things there may glow, and be intensely hot, but they cannot burn—which is to combine with oxygen—for there is no oxygen at all for the things to combine with. That is one answer to our question, but here is another. Very nearly the whole of the outside of the solid earth is already as burned as it can be, and so is all the water of the oceans. However hot we make them, and however much oxygen we have, we cannot burn water or sand or flint or clay or gravel, for these things are already burned. When the elements of which they are made have combined with all the oxygen with which they are capable of combining, then they are as burned as they possibly can be. Thus, the whole exterior of the earth, with only very scattered and slight exceptions, has already been burned up, and what we call the earth and the sea are the results of that burning. This burned crust now encloses the heat in the centre of the earth, and keeps out the oxygen of the air—the oxygen which has been left over, so to speak, from what has been used up in burning the crust of the earth.

WHY COULD NOT THE EARTH'S SHAPE BE ALWAYS UNDERSTOOD FROM AN ECLIPSE?

Of course, an eclipse of the sun by the moon would tell us nothing about the shape of the earth. So, to make our question quite correct, we should say not "an eclipse," but "an eclipse of the moon." Since this, as we know, is due to the earth's shadow creeping across the face of the moon because the earth is cutting off the sunlight by which the moon is lit, we are right and very thoughtful in supposing that the shape of the shadow ought to tell us the shape of the earth, just as our shadow tells our shape. And we find that the shadow is a convex one—that is to say, one curved outwards like the edge of a ball; in other words, it is a shadow of a globe or sphere, and since we know that the earth throws the shadow, that tells us the shape of the earth.

But this most important argument, though it is interesting now, could not be used in the days when men were disputing about the shape of the earth. It can only be used when we know what an eclipse of the moon really is; and we can only know what an eclipse of the moon really is when we have in our minds a picture of the solar system as it really is with the earth moving round the sun, and having the moon moving round

it as it goes. Though this all seems so plain and simple to us now, we must remember that we did not find it out, and that it took great labor and a very long time to find out. That is why those who argued long ago that the earth is round could not point to the shape of the shadow in an eclipse of the moon, and say that that proved their case. No one knew that that had anything at all to do with the matter.

WHAT WAS THERE IN PLACE OF THE EARTH BEFORE THE EARTH WAS FORMED?

Astronomers are not quite certain as to the details of the matter that existed in space before the earth was formed, and that gradually turned into the earth. This matter, indeed, probably passed through various stages quite different from each other. The simplest view, and one which is almost certainly true in the main, is that the last stage passed through before the earth was formed was that of a mighty cloud of glowing gas. It must have been very hot, for we have proof of that in the rocks, and in other ways; and as it was hot, it must have occupied a great deal of space. The earth upon which we live now is very small compared with that globe of gas, but, on the other hand, it is very much denser—for the earth has been steadily shrinking for countless ages, and we know that it is shrinking still. We may ask how it was that this great globe of gas came into being. We believe that it did so by separating itself from the great mass of which the remaining central part is our sun. The other planets were formed in the same way, and so we find the same matter in the earth, and in the other planets, as we find in the sun. This globe was a little sun, indeed, as the great hot planet Jupiter is still; it was so hot that it must have given out light of its own.

WHAT HAPPENS TO THE LIGHT WHEN IT GOES OUT?

We have to think of light as a kind of energy, a kind of disturbance full of power that is made in the ether. It is a thing that travels at a tremendous speed, and it is not capable of being still. When we have a steady light in a room, it is not that there is something in the room called light which is staying there, but that from every millionth part of a second to every next millionth part of a second new light is being steadily made. So we cannot keep light in a room as we keep anything material. If, for instance, we take a heap of sand into a room and then, putting it in a heap on the floor, do no more, it stays there until something removes it; but light stays nowhere, it is always moving; and if there is to be steady light in any place, there must be a steady source of light to produce it from moment to moment, or it will cease.

When we darken a room we cut off the source of light, and the light which was made an instant before is gone. Now we see why. But this question is a most important one, and people often forget to ask it. Nothing is lost, and the energy or power that made the light is not lost, even though the room is quite dark. If we could trace it we should find that it had been transformed into other things; it is transformed into heat, which we find in all the matter which it strikes—and this includes not only the furniture and walls, but also the air of the room; it is also changed into the power which starts chemical changes, as, for instance, when carpets and curtains gradually fade under its influence.

WHAT IS CAMOUFLAGE?

Camouflage is one of the things in which man has copied the animals. You remember how, in the story of Animals with Wonderful Coats, we have read of insects, birds and animals who look so like their surroundings that even at a short distance they cannot be seen by their enemies. In science that is called protective mimicry, in modern everyday language we call it camouflage.

We find many instances of camouflage in literature. A famous instance is told in Shakespeare's play "Macbeth." The besiegers of Glamis Castle hid themselves behind bushes so that as they advanced from the woods of Dunsinane the watchmen on the castle walls could not tell which was wood and which were soldiers.

The plaid worn by the Highlanders may be called camouflage. When the clansmen lay among the heather, they could not be distinguished from it. You remember in Scott's "Lady of the Lake," how, at the sound of a whistle blown by Roderick Dhu, his men rose up from among the heather, where a moment before they had been hidden because their plaids and kilts were so like it in color.

The Indians of the plains used camouflage when they wrapped themselves in buffalo skins to stalk the herds of buffalo that grazed on the plains of the West.

In the Great War, camouflage became a very important defence. Ships were painted in broken patches of color and with queer, wavy lines, so that they seemed to melt into the clouds and the men on the German submarines were puzzled where to aim. On land sharpshooters covered themselves with mud, or with canvas shields which were made to look like rocks. Canvas screens, painted to look like the surrounding country, or the land laid waste by warfare, were stretched along and above the roads; cows appeared to graze quietly in fields, where there really was an important railway line. Even the uniforms worn by the soldiers are camouflaged, for khaki color or olive drab reflects little light, and the men can be seen only at short distances. The word is French, and it was French artists who first thought of using protective mimicry, as a war defence, on a large scale. The term is an old one among French painters, and means to falsify in painting.

WHY DOES A PLANT DO BETTER IN A POT THAT HAS A HOLE IN THE BOTTOM?

A plant, like every other living thing, must have water. A plant does not take in water by its leaves or stems, but only by its roots. When we water a plant from above, the water has to sink into the earth until it reaches the roots—and we may forget to water it! But if the pot has a hole in the bottom, and stands in a saucer filled with water, the water soaks through the hole just to where it is wanted—the part where the roots are. So it is carried up through the plant, and at last given off by the leaves. Plants must have water running through them, and so must we. In them it mostly runs upwards, and in us it mostly runs downwards. It is probable, also, that a plant would do a little better in a pot with a hole in the bottom than in one without a hole, even if it were not fed with water in this way, for at least the hole would provide for ventilation, and the plant needs a constant supply of fresh air as much as we do. Growing in the earth, it gets that, but in a pot made of something through which air can pass only very slowly, the plant's ventilation is interfered with.

WHY DO WE NOT GET ALL WE WANT?

Some people do get all they want, at least for most of their lives, though the time comes for almost everybody when he wants to get well, and cannot. Now, if we study what happens to these people who get everything they want, even without having to work for it, we find that it is very bad for them. It is quite certain that we, and every part of our bodies, and every power we have, are naturally meant to work, to fight against difficulties; and it is better to fight, even if we do not conquer, than it is not to fight at all. One of the reasons why history records so many wicked and degraded kings is, that these were people who, all their lives, got everything they wanted. Every living creature that gets everything it wants given to it without striving is apt to become weak and degraded.

Many sensible grown-up people who have lived careful lives, and have had a fair chance in the world, know that they do get all they *really* want. No doubt they would like to have more money than they have, or, if they are a higher kind of people, more wisdom than they have; yet they know that if they work they will get enough for their happiness, and if wise people have that, they do not worry themselves by wishing for more. Children do not know what they can get, and what they cannot get. So all children, more or less, cry for the moon, as we say, not knowing how far away the moon is. As they grow up, they learn that it is not worth while to worry about things they cannot have, but that it is much better to work hard for the things they can have.

WHAT IS IT MAKES US FEEL HUNGRY?

Most people confuse some very different kinds of things together, and call them all hunger, but that is a very bad and a very serious mistake. When a man has had a good dinner, and has perhaps eaten more than he should, and then eats a chocolate, or drinks a glass of liqueur, or takes a crystalized fruit, he is doing something which may, or may not, be quite harmless; he is taking something that he likes, but what prompts him is certainly not hunger. We eat and drink a great many things at meals, and between meals, just because

they are pleasant to our senses of taste and smell. These senses like to be pleased, just as our other senses do; but we no more satisfy hunger by taking a pleasant sweet because it has a nice taste and smell than we do by listening to singing.

Real hunger is quite a different thing, and the place where it really is caused is neither in the mouth nor in the nose. A person who is really hungry will eat dry bread, or tasteless oatmeal porridge, without milk, cream, or sugar, and he will find it delicious. Real hunger is a state of the blood. The blood has used up much of its food material, and needs more. As it passes through the brain, the brain—which is where we feel everything—finds that the blood has not sufficient food materials in it, and it sets the body asking for more. That is true hunger, and if we ate only to live, we should eat only when we had this true hunger. If we eat too much, or without being hungry, we eat to die in the long run.

WHAT MAKES THE PUPIL OF OUR EYES GROW LARGER AND SMALLER?

If we think of a very small, but thick, india-rubber ring, we shall understand the answer to this question. The pupil is simply the hole inside this ring. The ring itself in our eyes is not made of india-rubber, but it is elastic. It is made of muscular fibres that run round the pupil, and enclose it. The name of this ring is the iris. In front of the iris and behind it there are layers of cells which contain coloring matter, and it is these that give our eyes their color. When we look at anyone's eye we can see this colored muscular ring and the black hole in the middle of it. When the little muscular fibres contract, the pupils grow very small. We can see this happen in anyone if we cover his eyes, and then suddenly throw a strong light upon them. We may see this, too, in a person who has taken too much opium, for opium makes the iris contract very strongly, and so a person under its influence has "pin-point" pupils. In the darkness the iris relaxes and stretches, and then the pupil gets very large. Foolish people sometimes drop belladonna into their eyes, since this drug poisons and paralyses the iris, and the pupils grow very large and the eyes look brilliant. But the eyes suffer, for they cannot now protect themselves from a bright light by shutting off part of it. The use of this beautiful arrangement is to regulate the amount of light falling into the eye. If we go into a darkened room straight from the sunlight, we can see nothing. In a few moments things become visible. The reason is that our iris has relaxed, the pupils have become larger, and more light is entering the eye.

WHAT IS THE LOOFAH SOMETIMES USED IN THE BATH?

The loofah looks like a stiff, fibrous piece of netting, and because it is tough, not brittle, it makes a capital thing to use for a good brisk rub when we are bathing. But it is not made by hands. It is the fruit of a plant, and belongs to the same family as the cucumber. The cucumber is not fibrous, or we could not eat it, and the loofah, or luffa, differs from it in this respect. Of course, the loofah is not, in its natural state, like the loofah of the bath-room. The loofah that we use is simply the fibrous skeleton of the cucumber, or gourd, that grows in Egypt. After the fruit has ripened it is dried, and the fleshy part disappears, leaving only the fibres, and these are so strong, and stand the action of water so well, that a loofah lasts quite a long time. There are about ten species of loofah, and one sort, grown in the West Indies, is used as a sponge or dish-cloth.

WHAT MAKES SHADOWS AND REFLECTIONS?

Both shadows and reflections depend, of course, upon light, but they are very different things. Everything we see, except the light of a candle, or the sun itself, or some other luminous body that gives out light of its own, is a reflection—that is to say, what we see is the light reflected from the surface of the thing. Now, a shadow may sometimes look like a reflection, and people sometimes mix up the two words, but there is a great difference. In the picture on page 3511, of some boys on a wherry, what we see is the reflection of them in the water. If the sun were behind the boys, then their bodies would interfere with the rays of light as they approached the water, and the water would show shadows which might be of just the same shape, or almost the same shape, as these reflections are. There is nothing difficult to understand about a shadow. Of course,

the whole of these shadows would be evenly dark, unless there was some part of the boys that was transparent and let the light through. What we see in the picture are not shadows, because, for instance, the white tie of the fourth boy from the left is shown white in the water.

What has happened here is that the light, striking the front of the boys, and coming off from them in straight lines in all directions, has been reflected from the surface of the water, which must have been perfectly still like the surface of a mirror. There can have been no wind when this photograph was taken. In such a case water may be a very nearly perfect mirror. Yet it is not perfect, for some of the light passes through the water, and is there absorbed instead of being thrown back, or reflected, to our eyes. So, at all points, the reflection is less bright than the images of the boys themselves. If the water had thrown back perfectly all the light sent to it, there would not be this difference. Let us compare, for instance, the whiteness of the boy's tie and the reflection of it in the water.

The sun is shining upon the front of these boys, and so we see their reflection in the water, as the white tie of one of the boys proves. If the sun were behind them we should see their shadows in the water.

WHAT WAKES UP THE BIRDS?

Sleep is a very mysterious thing about which we do not know much yet, but at any rate we are certainly mistaken when we think that sleeping creatures only wake up when something arouses them from outside. It is possible to study the exact amounts of noise that will wake people at different parts of the night, and we know that as morning approaches, healthy people or animals sleep less and less deeply, so that things wake them which would not have wakened them in the earlier part of the night. Healthy creatures probably either wake up quite apart from anything outside them, and because their brains have now rested long enough and are ready to start work again; or else their brains are just ready to wake up with the least thing, and some little noise or light—it does not need much then—gives the necessary signal.

So we may say, and it is perfectly true, that it is the light which wakes the birds, just as it is the dark that sends them to sleep. We know that during a total eclipse of the sun, when it gets dark in the daytime, the birds fold their wings and start to go to sleep. Of course, they very soon find out that they were wrong. But though the light of dawn, or perhaps the voices of other birds that have awakened a little sooner, seem to do the waking of the bird, yet we must understand that waking and sleeping, in all living creatures that wake and sleep,

really depend, not on what is happening outside, but on changes that go on steadily to and fro inside the creature in question, especially in its blood and brain.

ARE THERE ANY PEOPLE IN THE OTHER WORLDS?

This is a great question, to which no one can return a certain answer, and about which many big books have already been written and many more will be written. But of something we can be sure. People sometimes talk as if there could be *men* on other worlds, but we may be sure, when we think of the wonderful way in which men are adapted to this earth of ours, to its air, and water, and climates, and food supply, that there could be men like ourselves only on a world *just like ours*, and we certainly do not know of the existence of any such world. Those we know all differ greatly from our earth in all sorts of most important things, such as the composition of the air. *Man*, then, is a child of earth—this particular earth of ours; he is exquisitely fitted for it, and it for him, not only in its air, and soil, and oceans, and heat, but also in the kind, and the balance, as we may say, of the thousands of animals and plants that inhabit it with him. We are certain that men and women and children like ourselves could be found only here, or on some other world, unknown to us, which is an exact double of our earth. Such a world is quite unlikely to exist anywhere.

IS IT POSSIBLE THERE MAY BE LIVING CREATURES ON OTHER WORLDS?

This question is a very different one indeed from the last, and we need have no doubt at all that the answer is "Yes." To begin with, it would surely be very extraordinary, would it not, if *life*, which is the highest thing we know, and with which earth, and air, and sea are crammed, were confined, in this mighty universe, only to our little earth; if all the other worlds, big and little, far and near, were *dead*, and only rocks or glowing fires?

Then, again, we know that other worlds are made of similar materials to those that make our own earth, and we are sure that the laws of matter and chemistry apply everywhere, so that if life could be maintained on our earth, it might be maintained on many worlds. Further, we know that life has an endless power of fitting itself to outside conditions. Life flourishes on our own earth in extreme cold and great heat, on almost dry rock, and in the depths of the sea. So he would be a rash man who declared that life could not find, on other worlds, conditions fit for its development. More than this, we have some hints—and more than hints—of real evidence that life exists on some other worlds, such as Mars.

ARE THERE MEN ON MARS?

The answer to this must certainly be "No," as astronomers have shown us that Mars is very different from the earth in many ways. It is smaller, so that the power of gravitation is less; it has very little water; its heat is probably very different—perhaps much hotter than the earth by day, and much colder at night; and it has not much atmosphere. For these, and a host of other reasons, any living beings on Mars must be very different from men in a number of ways. But, on the other hand, we can see on the surface of Mars markings which must almost certainly be due to strips of vegetable life, and it has been proved that water exists on Mars, though this used to be denied. Also, we know Mars has an atmosphere, though one very different from ours.

CAN THERE BE ANY KIND OF INTELLIGENT LIFE ON MARS?

It is almost certain that there is life of some kind on Mars, and some people believe there are thinking beings on Mars—not men, yet beings who might understand men, and whom men might understand when they learned to know each other's way of expressing themselves.

Some people who have given their whole lives to the study of Mars are quite certain that there are marks upon its surface which only intelligent beings could have made, and are even sure that all the "Martians" must be one great family who live in a friendly way, and have given up fighting each other as men still do, for the marks on Mars, it is thought, could only have been made by a race of beings who had given up wars, and frontiers, and quarreling, and worked all together for the good of all. Perhaps the children who read this answer may live long enough to learn for certain what is the truth about the "canals" of Mars,

and how they came to be made. There are few more interesting questions in the world.

WHAT IS THE USE OF THE PLANETS THAT HAVE NO LIFE ON THEM?

No doubt some of the planets have no life upon them, and no doubt life is the highest thing that can exist on a planet. But we have every reason to suppose that life will develop at some later date upon the planets, such as Jupiter, which are now too hot to bear it, just as our earth once was. So we might say that these planets are preparing for the "use" of bearing life. There may be other planets which are now too cold, but once had life upon them; and there may be planets which never had and never will have life upon them. We human beings may, perhaps, be able to make use of them by watching their movements in the sky, and that is all. But, though they are of no use, or little use, to us, perhaps they have a use and a meaning for their Maker.

WHAT IS THE USE OF STARS THAT ARE TOO FAR AWAY FOR US TO SEE?

People have tried the hopeless task of proving that even the stars which are too far away for us to see have some use for mankind—that perhaps they send us some kind of radiation which is useful for our eyes. There is no proof of this, and nothing is less likely. Probably the use of the stars which are too far away for us to see, and the use of the stars which are not too far away for us to see, are the same as the use of the star which we can see best, and which we call the sun—to support and nourish life in their neighborhood. And if there are stars which have no such use, and which certainly might not exist for all the difference they make to us, yet there are more uses and purposes in the universe than we can guess or dream of.

WHY DO WE WANT TO WALK MORE SLOWLY UPHILL THAN DOWN?

When we walk on the level we have only to work against such things as the resistance of the air, and the weight of our legs as we lift them up and down. When we walk downhill, less effort is required on our part in some ways because, in walking downhill, we are to a certain extent falling—that is to say, we are being pulled nearer the centre of the earth. Yet in course of time, especially if a hill is very steep, it may be very fatiguing to walk down it, because we have to balance ourselves so carefully. This is owing to the strain on our toes pressing against the inside of our shoes, and the half-conscious fear in our brain that we may be pulled down too quickly and hurt ourselves. When we walk uphill the work is very hard, because then we have, by sheer muscular effort, to lift our whole bodies away from the centre of the earth in defiance of gravitation. We have to exert in the opposite direction a greater force than that of gravitation.

DO WE USE MORE ENERGY IN WALKING UPHILL THAN ON THE LEVEL?

The difference can be measured in such cases, and it is said that to walk up a steep hill at a given pace costs us more than twenty times as much effort as to walk at the same pace along the level. No wonder, then, that we want to walk more slowly uphill! The reason is really exactly the same as the reason why we lift a heavy weight in our hand more slowly than we let it down. In one case we are pulling against gravitation, and exerting a greater force than gravitation; in the other case we are exerting comparatively little force against gravitation so that the weight shall not fall down to the ground too quickly.

This difference—whether we walk against gravitation or with it—shows in another way. It is not much use for a stout man who wishes to become thinner to walk on the level. Let him walk uphill, and he will soon find that he requires to burn away a lot of his fat to provide the power that will lift his body against the earth's pull.

WHY ARE WE GIDDY WHEN LOOKING DOWN FROM A GREAT HEIGHT?

Everyone does not become giddy when looking down, and anyone who is in good health can learn in time by practice how to look down from a height without turning giddy. There are two explanations of this giddiness. One is the general explanation that the fear of falling disturbs the working of the brain. Now, our sense of being balanced, and our feeling that we are able to balance ourselves, depend upon the proper working of the brain; and so the fear of falling may make us giddy, just as giddiness may be caused at times by other kinds of fear.

But people who are not in the least afraid, or who did not at all expect to be

afraid, may turn giddy when they look down from a height, and there is a very interesting explanation of this. Part of our power of balancing ourselves depends upon vision. We know how one is likely to bump against a companion when walking at night, for instance. And even though we can balance ourselves without the aid of sight, yet we are likely to feel giddy if our eyes play us any tricks, and that is what they do sometimes at a height.

WHY, WHEN WE LOOK FROM A GREAT HEIGHT, DO THINGS SEEM BLURRED?

As a rule, anything we look down to see is quite close to our eyes—a few inches when we are reading, for instance, or a few feet when we look at the ground; and it is the rule that when we look at anything near, our two eyes turn inwards towards each other slightly, or converge, as we say. The eyes are so accustomed to converging when they look downwards—as the things they look down on are usually near, and as the two eyes cannot see a near thing well unless they converge slightly in looking at it—that they do the same when we are on a height, and perhaps the nearest thing is the ground, hundreds of feet below us.

In order to see a thing so far away, our eyes should look straight out, parallel with each other. But until we are accustomed to look from high places, the eyes converge, and so are bound to give us a blurred view of the ground. Then we feel that we cannot see properly and become frightened and giddy. This is what students of the eyes believe, but we ought really to make experiments with people who hold the hand over one eye when they go on high places, and to see whether they feel more comfortable when they do so.

HOW CAN PLANTS GROW ON A BARE WALL?

One of the most important parts of the food of green plants is found, as we know, in the air. That is the carbon dioxide, which provides the plant with its carbon. But that, of course, is not all. The plant must have water, and it must have salts. Now, a bare wall is not as bare as we think it, when we come to examine it closely. In the first place, rain falls upon it, and so the plant gets its water. Nor is this all. Rain itself contains minute quantities of salts which are valuable to the plant; and as it trickles down the wall, it gains more. It has the power of melting, out of the wall, salts that may be contained, for instance, in the mortar. We know that lime is very valuable for plants, and mortar is really a kind of lime. So we find on examination that plants can obtain, even growing on a bare wall, those things that are necessary for their life. But, of course, the supplies of certain essentials are very scanty, and the forms of plant life which can grow in this fashion are very humble, and never reach a large size. Very different is the case of the plant that grows over the bare wall, but has its roots in the earth, from which it draws nourishment.

WHY DOES THE BOOMERANG COME BACK?

Some people suppose that the boomerang comes back after hitting the thing at which it is aimed. That would really be very convenient indeed when the instrument is used in the chase, but it does not happen. The first part of the boomerang's path is straight, or practically straight. It is expected to hit its object while it is in this part of its path. If the boomerang were flying through nothing, it would have to fly *always* in a straight line, according to Newton's great law of motion.

But the boomerang is flying through air, and it is so shaped that the air resists one part of it more than another, so that it has to travel in a curved path after its speed has slowed down below a certain rate. As it travels in a curve, it *more or less* comes back to the place from which it started. Endless study has been devoted to finding why the boomerang must be its exact shape, what are the consequences if its shape is a little different, what is the speed at which it begins to curve, how its weight and size affect the curve, and what is the relation between the curves of the boomerang itself and the size of the curve it makes in the air. But these questions are immensely difficult, and still undecided. If the boomerang, instead of being *gradually* slowed down, is arrested entirely in its flight, as when it hits something, it simply drops "dead," as we might say. Perhaps the most wonderful thing about the boomerang is the fact that it has been brought to perfection among the natives of Australia, who are almost the lowest race of mankind.

THE NEXT QUESTIONS ARE ON PAGE 3567.

THE NOVELS OF THACKERAY

THE first great success among the stories of Thackeray was that of "Pendennis." It began to appear in instalments in November, 1848, and had been preceded by "Vanity Fair," which at first did not attract great attention, but had made the reputation of its author before it was finished. "Pendennis," on the other hand, was a success from the beginning. It is a very long story, describing the life of an imaginary young man, who is very far from being a hero, as his faults are quite as pronounced as his good qualities, and sometimes far more evident. The genius of the author is seen in the fact that, although he never endeavors seriously to win our affections on behalf of Arthur Pendennis, he maintains our interest continuously in his character, which is the most difficult task of a novelist.

THE STORY OF PENDENNIS

CONTINUED FROM 3424

THE Arthur Pendennis with whom our story opens is not he whose history it attempts to tell. Major Arthur Pendennis was an elderly bachelor, who, having served his time in the king's army, and retired on his pension, contrived with much ingenuity to cut some figure among the dandies of his day, although his means were of the scantiest. He just missed falling into the ranks of those who are known as the "shabby-genteel," and being a perfect worshipper of rank and title, he was ever to be found where anything was to be gained from association with people more wealthy and distinguished than himself. That is to say, he lived a good deal on the credit which his familiarity with the noblemen of the day earned for him in the minds of those who were not themselves favored with the friendship of those great ones.

Major Pendennis was seated one morning in his club, with a little heap of letters before him, most of which were from lords and ladies inviting him to honor them with his presence at their different parties; and he was making mental notes as to how he could fit in the various engagements, which to accept, and which to decline, when all his plans were upset on opening the last letter of the heap. This was written by his nephew and namesake, Arthur Pendennis, and the reading of it sent the major purple with indignation. It is with this Arthur Pendennis that our story is concerned, and later on we shall discover why his letter made the major so ill-tempered.

A good many years before the day on which Arthur's letter was read by his uncle at his club in Pall Mall, Mr. John Pendennis, the brother of the major, and father of Arthur, had carried on business as an apothecary and surgeon in the city of Bath. John Pendennis was a quiet, old-fashioned, economical man, and by dint of careful saving he was able at last to fulfil the dream of his life. Selling his business, he bought a little estate near the small town of Clavering, and settled down there for the remainder of his days as a country gentleman.

This little estate was on the fringe of the greater one of Clavering Park, and, naming it Fairoaks, Mr. Pendennis felt that he could hold up his head with any of the landed proprietors in the district. He assumed all the airs of a gentleman of long lineage, boasting a pedigree that went back to the time of the Norman Conquest. His young wife, who had been a Miss Helen Thistlewood, he had also chosen because she was a very distant, although very poor, relative of the noble house of Bareacres.

Thus the quaint little snob began quite late in life his new career as John Pendennis, Esquire, of Fairoaks, Gentleman, his humble days when he dealt in drugs and porous plasters quite forgotten. Portraits of great Pendennises of the past, such as Roger, who fought at Agincourt, and Arthur, who carried himself so well at Cressy,

and many another Pendennis hero hitherto unknown to fame, came from none knew where to adorn the walls of Fairoaks mansion.

Mrs. Pendennis herself was a gentle-natured woman, who had a profound admiration for her elderly husband, and doted upon her boy Arthur. The result was that when Mr. John Pendennis died, and Arthur had reached the age of sixteen, that young gentleman had been spoiled on all hands, and too suddenly became conscious of his own greatness as the new Squire of Fairoaks. His uncle would have had him go back to Greyfriars School and continue his education, but Arthur coaxed his mother to let him remain at home, the lord of his estate.

SOMETHING ABOUT A YOUNG LADY OF IMPORTANCE IN THE STORY OF PENDENNIS

This was the beginning of his many follies, for his home studies were confined to some daily readings in the poets with Mr. Smirke, the curate from Clavering, and the writing of passionate verses imitating the style of Byron, which were published in a local paper. For the rest, he fancied himself a very gay young man, interested in sport, and inclined to regard his mother and his adopted sister, Laura Bell, as very slow-going and old-fashioned, although he had a sincere love for them both.

As Laura plays an important part in the story, we should know something about her here. Long before Miss Helen Thistlewood had imagined she would marry an elderly little gentleman with a bald head, there was a poor young graduate of Cambridge University with whom she was in love. But the Rev. Frank Bell had so long to wait for a church that he and Helen drifted apart, and in the end he went abroad and married there.

It was after Helen had become Mrs. Pendennis that both Mr. Bell and his wife died, and their daughter Laura, who inherited a tiny fortune, was adopted by Mrs. Pendennis. She had proved herself worthy of Helen's love and care, and was now growing into a beautiful and adorable young woman. Laura's admiration for Pen, as her adopted brother was familiarly called, was so frank and whole-hearted that Helen nursed fond dreams of a great happiness she hoped to experience some day, when Laura might consent to please her by doing a certain thing. And in due time we shall discover whether Laura made her happy.

ARTHUR FANCIES HE IS IN LOVE AND BEHAVES VERY FOOLISHLY

We must now return to the doings of Pen, for that handsome young man was certainly as active as he was foolish; and his history, when fully told, is indeed a long one.

It happened one day that, when Pendennis was in the county town of Chatteris, whither he had ridden over to deliver a new poem to the editor of the local paper, he fell in with a very over-dressed and horsy young fellow named Foker, whom he had known at school. Harry Foker was no suitable companion for him, being densely stupid, and interested only in low sports, for which he was well supplied with money. His father was a rich brewer who had married Lady Agnes, sister of the penniless Earl of Rosherwood, to one of whose daughters Harry was engaged to be married. Pendennis was greatly impressed by the expensive dinner to which Foker invited him, and gladly accepted his invitation to accompany him to the theatre, where an actress, whose stage name was Fotheringay, was performing. The play was a great experience for Pen. The actress seemed to him a veritable queen of tragedy, and he was back in Chatteris next day to enjoy at the hand of Foker the great privilege of being introduced to her father.

This person, who was known as Captain Costigan, was an Irishman, much given to drinking and boasting of his tremendous exploits, although he had clearly fallen on evil days, as his clothes were shabby and dirty, and his once handsome face had not been improved by his love of drink.

But, fluttered as Pen had been at the thought of meeting the captain, his delight was unbounded when that frowsy person invited him to meet his daughter, "the peerless Fotheringay." Although she was a beautiful woman, and later on became famous as an actress in London, she was uneducated and stupid; but poor bewitched Pendennis thought her a very queen, worthy of his homage.

While the rascally Captain Costigan encouraged Pen in every way, his

HOW PENDENNIS' DEBTS WERE PAID

"You know, mamma," said Laura, "that I have been living with you for ten years, and you have never taken any of my money. Now, if I had gone to school it must have cost me at least fifty pounds a year, so that I owe you fifty times ten pounds, which doesn't belong to me. So we will go to the lawyer and ask him for the five hundred pounds, and I dare say he will lend you two more, which we will pay back; and we will send the money to Pen, who can pay all his debts without hurting anybody, and then we will live happily."

daughter received the admiration of the youth in a very matter-of-fact and unromantic way. But, to the dismay of all his friends, Pen announced his intention to ask the tragedy queen to become his wife, and had almost induced his mother to give her consent, when Dr. Portman, the vicar, suggested sending for his uncle, the major.

Pen himself determined to write to his uncle, informing him of his mad intention to marry the actress, with whom he foolishly imagined himself to be in love. It was a frank and manly letter that he wrote; but, none the less, as we already know, when old Major Pendennis opened and read it at his club, it threw him into a violent temper, and speedily brought him to Fairoaks.

HOW MAJOR PENDENNIS PRESERVED THE "HONOR OF HIS FAMILY"

The old campaigner did such good service in the sacred cause of his family by talking to Captain Costigan and rendering that needy person a little service, that the captain had no difficulty in persuading his daughter to write a brief note to Pendennis releasing him from his promise to marry her; and although the foolish youth talked wildly of dying, he did nothing of the sort.

Pen wrote many more verses full of sadness and sorrow, and after a time decided that he would go to Oxbridge University in order to study for some career, the exact nature of which was not quite clear to him. So Mrs. Pendennis had to scrape together all her savings in order that Pen might go away well provided.

At the University he conducted himself more like the son of a rich nobleman than a small country squire. In personal appearance and in mental gifts he was probably better fitted to be a nobleman's son than many who were such in reality, and he speedily became the most popular of all the students.

Yet he never did what was expected of him.

PENDENNIS LIVES LIKE A LORD AT THE UNIVERSITY AND GETS INTO DEBT

All the prizes, which, it was thought, he had only to try for in order to win, were carried off by others, and the brilliant Pen contrived to do nothing more original than run deeply into debt. Every penny his mother could find for him was spent, and at the end of two years, when he had failed in his examinations and found himself seven hundred pounds in debt, he fled from Oxbridge to London, where his uncle, who had been mightily pleased to hear of Pen's lordly acquaintances at the university, gave him the cold shoulder on learning of the scrape he had got into.

Thus turned away by the major, who was ready enough to help when the "honor of his family" was at stake, but, desperately poor himself, could take no interest in his nephew's money troubles, poor Pen behaved as many another prodigal son had done before, and, writing to his mother, announced that he was coming home to throw himself upon her kindness, which he had so grossly abused. Mrs. Pendennis, gentle soul, was full of forgiveness for her boy, and there was another who shared with her the determination to help the foolish young man out of his scrape.

"You know, mamma," said Laura, "that I have been living with you for ten years, during which time you have never taken any of my money, and have been treating me just as if I was a charity girl This obligation has offended me very much, because I am proud, and do not like to be beholden to people.

HOW ARTHUR'S ADOPTED SISTER THOUGHT OF A WAY TO PAY HIS DEBTS

"Now, if I had gone to school—only I wouldn't—it must have cost me at least fifty pounds a year, it is therefore clear that I owe you fifty times ten pounds, which doesn't belong to me a bit. Now, to-morrow we will go to Chatteris, and see that nice old Mr. Rowdy, with the bald head, and ask him for it—not for his head, but for the five hundred pounds, and I dare say he will lend you two more, which we will save and pay back; and we will send the money to Pen, who can pay all his debts without hurting anybody, and then we will live happily ever after."

Thanks to this little plan of Laura's, Pen's debts were paid, and although he had to observe many little economies in his life at Fairoaks, and had to see his devoted mother and Laura stint themselves for his sake, he could think of nothing better to do than the writing of gloomy poetry. It was due to Laura that at length he determined to return to the university, where, behaving very differently, and applying himself to his studies, he took his degree without difficulty, and again came back to his aimless and despondent life of idleness at Fairoaks.

An event of some importance in the history of Arthur Pendennis now happened. Clavering Park, the great mansion of the countryside, was to be reopened, and after many years a Clavering was to be in residence there again. Sir Francis Clavering was a person of very doubtful reputation, and had at one time been an inmate of the debtors' prison, before he went abroad to make a living by means best known to himself. Luckily for him he had married in Calcutta the daughter of a wealthy indigo planter, named Snell, and came into possession with her of a large fortune. She was understood to be the widow of a ship's officer named Amory, who had mysteriously disappeared, and she had one daughter, Blanche.

PENDENNIS' LIFE AT FAIROAKS AFTER HIS RETURN FROM THE UNIVERSITY

It was great news for the district that Clavering Park was once more to awaken into a life of gaiety and activity, and Pendennis was not the least of those interested in the prospect of some new excitement in the dull and purposeless life he was living. His little estate adjoining the great one, meant that Fairoaks would, to some extent, share in the revival of Clavering Park.

Nor was he at first insensible to the charms of Miss Blanche Amory, the daughter of Lady Clavering. This young lady, very fair and pleasant to look upon, had a romantic turn of mind, which led her to poetry of much the same character as Pen had affected. Sadness was the keynote of their thoughts, although neither had any reason for sadness, except the wish to appear romantic, after the style of Lord Byron.

Pen took to fishing in the river, and Blanche also discovered some new interest in walking there. They exchanged their sad and sorrowful verses, and there was a certain hollow tree that made a most romantic post-office, where they could leave letters for each other. But when, in the course of time, the great families of the county, who at first had stood aloof from the Claverings, began to show friendliness to Sir Francis and his family, thanks to the wealth of the widow Amory, Miss Blanche curiously lost her taste for these romantic little walks and the delights of the hollow tree post-office.

PENDENNIS GOES TO LONDON TO WORK FOR FAME AND FORTUNE

After a time, Arthur Pendennis suddenly realized that he had not done all that he might to make his mother happy, and he determined that he would go to London to study law. After he had won a name for himself, he thought, he would return to fulfil the wish of his mother's heart by marrying Laura.

As Pen had been a spoiled child all his life, and had so often found those who loved him ready to make sacrifices on his behalf, he was now not a little surprised and a great deal offended when Miss Laura saw fit to reject the noble offer of his hand and heart, and when he went to London it was with the feeling that he had been very badly treated. The fact was that the selfishness in his nature had been allowed to grow too strong, and he stood very much in need of a wholesome lesson in conduct. It was as fortunate for herself as it later was for Pen that Laura had the good sense to teach him this much-needed lesson.

In London, Pendennis shared chambers with his old friend, George Warrington, a younger son of Sir Miles Warrington. George was one with whom fortune had not gone smoothly, and here, in London, he lived a very wretched life, into which Pendennis, with his newly awakened ambitions and his poetic posings, came like a breeze from the old school-days.

Pen could not have chosen a better companion than the shabby Warrington, who had still the instincts of a gentleman, and could give the young and thoughtless Pen some sound advice.

PENDENNIS DREAMS OF BECOMING A GREAT POET LIKE LORD BYRON

But Warrington did better than this. He suggested to the erratic youth an honorable way of earning money. He himself was writing for the papers, and so avoiding the need to borrow from friends. Why should not Pendennis do the same, and better? For there was no doubt that he had considerable literary talents. So Pen would be a poet for pay, and earn great sums of money, as Lord Byron had done before him! Warrington laughed at the absurd enthusiasm of Pen, and induced him to fly at smaller game, with the result that the young Squire of Fairoaks was presently making his way as a contributor to the newspapers and magazines, bidding fair to be a successful journalist. Soon he began to consider himself an extremely noble young man indeed, when he was able to send small sums of money to his mother, though these were but very tiny instalments of the debts he owed to her and Laura.

PEN BEGINS TO WIN FAME AS AN AUTHOR AND JOURNALIST

But, although he was not above spending his evenings in the taverns where Costigan and his cronies gathered, he still maintained the grand manner and noble bearing he was supposed to have inherited from his long line of ancestors, much to the amusement of Warrington, whose ancestors, as we know from "The Virginians," had been really distinguished.

Yet Pen held on his course in the new work he had found, and as a journalist and author he began to prosper. A novel which he wrote made his name known, and even the old major, scenting the possibility of fame for his nephew, began to revive his interests in the honor of the Pendennis family.

Just at this time Pendennis was stricken with illness at his rooms in the Temple, where poor little Fanny Bolton, the pretty daughter of a Temple porter, had come to nurse him. As soon as the news reached the major, he arrived with all haste at the bedside of the invalid, and there met Mrs. Pendennis and Laura, who behaved none too well to poor Fanny. George Warrington had gone away from town before Pen took ill, and was therefore absent when Major Pendennis and the

others came to the rooms he shared with Arthur, but he returned to find the ladies in possession, and to discover in his heart a deep and true affection for the gentle Laura Bell.

PENDENNIS RECOVERS FROM THE FEVER AND LOSES HIS DEVOTED MOTHER

It was a wonder to him how Pendennis could ever have been insensible to the personal charms and beautiful character of that young lady, for whom he himself would willingly have given the whole world. And Laura on her part recognized at once the true gentlemanliness of Warrington, admiring the strength and independence of his character, and contrasting him with Pen and his dandyism, by no means favorably to poor Pen.

When Pen recovered from his fever, instead of striving to please his devoted mother, who had wept over him and borne with him so long, he acted with his old foolishness by declaring that Helen and Laura had done a great wrong to Fanny Bolton in turning her away from her nursing duties at his bedside, and that he meant to marry the porter's daughter. The major, of course, was frantic at this new whim, and Mrs. Pendennis was prostrated with grief and weakness; but not until George Warrington had told him of his own unhappy married life, and warned him against the danger of offending those who loved him best, did Pen regain his sober mind and go to his mother subdued. It was almost too late, for Mrs. Pendennis, who had been suffering in silence, died as she kissed her son, to whom her whole life had been devoted.

After the death of his mother, Arthur Pendennis was greatly changed, though he was still far from having reached true wisdom. As soon as the period of mourning was over, the major, more anxious than ever to maintain the "honor" of the Pendennises, set about discovering a rich wife for Pen, while Laura now went to live with Lady Rockminster, who had the good sense to understand and appreciate the sterling character of that noble girl.

In the course of his explorations among the rich and titled families of the day, old Major Pendennis found himself a guest at the town house of Sir Francis Clavering when an extraordinary scene took place. A strange person, in a tipsy state, forced himself into the room as dinner was in progress, and created a great disturbance. The stranger was known to some of the party as Colonel Altamount, an adventurer from India; but when his eye caught sight of Major Pendennis, he suddenly reeled towards the door, and was heard to mutter as he fled the place: "Captain Beak! Captain Beak! By Jingo!"

Sir Francis had shown the greatest fear and trembling when this unruly stranger appeared upon the scene, and it so happened that the old major recognized in a flash who this Colonel Altamount was. He had seen him before as one of a convict gang in New South Wales, and had good reason to believe he was none other than Amory, the scoundrel who had induced the present Lady Clavering to marry him when she was Miss Snell. Such was the fact, and Altamount had been preying upon the fears of Sir Francis by making that person supply him with money in order to keep quiet.

Both Sir Francis and Amory were men of low character, and the major, who was none too particular for a gentleman, while caring for neither, determined to make some use of this knowledge he happened to possess. So he made a proposal to Sir Francis Clavering.

"I want my nephew to enter public life," he said. "I want him to marry Miss Amory, and I want you to resign your seat in parliament in his favor. Nobody need know anything more about it." And thus we see that in his ambition to have a Pendennis eminent in the public life of his country he did not scruple at driving a bargain with a rascal in a corner.

So it came about that in a few days more the major was able to apprize his nephew of the good fortune that had opened up for him. For it was before the days of honest voting for members of parliament, and people of wealth and position could do pretty much what they liked in obtaining admission to the House. Pen, of course, had no idea of the means whereby Sir Francis resigned his seat to him, and accepted it naturally as a reward for his own great abilities, which he esteemed, perhaps, more than did the world at large.

PEN SURPRISES HIS UNCLE, THE MAJOR

Trading on a secret, Major Pendennis had got Sir Francis Clavering to resign his seat in parliament to Arthur Pendennis, and to promise a fortune to him if he married his stepdaughter. On getting to know the secret, Pendennis was indignant, and accused his uncle of base conduct. "I'll keep my promise to Miss Amory, sir," said Arthur; "but I will let Clavering off from that bargain that was made without my knowledge. I will take no money with Blanche but that which was originally settled upon her."

THE MAJOR THINKS HIS LITTLE SCHEME IN FAVOR OF PEN IS SUCCEEDING

Pen did not take his uncle quite seriously when he suggested that Pen should become the husband of Miss Blanche Amory; but none the less he presently found himself a favored guest of the Claverings, and the old days of exchanging poetry and romantic walks together had come back again; with this difference, however, that Arthur now had the encouragement of Lady Clavering and Sir Francis, and, better still, the rivalry of his old friend, Harry Foker, who, in his simple, stupid way, had fallen in love with Blanche.

Before long, indeed, the major had the delight of knowing that his nephew was engaged to Miss Amory, and the worldly old fellow rubbed his hands with pleasure as he watched the success of his plans. Unhappily for the major, he had reckoned without allowance for the erratic character of his nephew, in whom the impulse to do the straightforward action was often stronger than the readiness to take a mean course, though his intentions were sometimes better than his deeds.

Judge, then, the consternation of Major Pendennis when his nephew discovered the real reason for Sir Francis Clavering retiring from parliament in favor of Arthur Pendennis. The major had suffered many surprises due to the conduct of his nephew, but all were eclipsed by the shock he received when one day Pen burst into his room indignantly and rated him soundly for the mean compact he had made with the baronet.

PENDENNIS REFUSES TO DO A BASE THING AND RUINS THE MAJOR'S PLANS

"Can't you see, sir," cried Arthur, "that rather than profit by this secret I would go and join my prospective father-in-law in the hulks? Can't you see that you have given me a felon's daughter for a wife, and doomed me to poverty and shame?"

"What, in the name of wonder, can you mean, sir?" asked the major, in a voice that betrayed his pain and alarm.

"I mean to say that there is a measure of baseness which I can't pass," Arthur answered. "I have no other words for it, and I am sorry if they hurt you. I have felt, for months past, that my conduct in this affair has been wicked, sordid, and worldly. I am rightly punished by the event, and for having sold myself for money and a seat in parliament by losing both."

"How do you mean that you lose either?" shrieked the old gentleman. "Who is to take your fortune or your seat away from you? Clavering shall give it to you; you shall have every shilling of eighty thousand pounds."

"I'll keep my promise to Miss Amory, sir," said Arthur; "but I will let Clavering off from that bargain that was made without my knowledge. I will take no money with Blanche but that which was originally settled upon her, and I will try to make her happy. You have done it. You have brought this upon me, sir. But you knew no better; and I forgive——"

It was in vain that the old man begged of Arthur, who was now feeling tremendously virtuous and noble, to take a more worldly view of the situation. He even went down on his knees to him, which was an extraordinary effort for the proud old major, but he was desperate at seeing his cherished scheme thus fail to carry.

IN THE CRISIS OF HIS LIFE PEN SEEKS ADVICE FROM LAURA

In this crisis of his life he fortunately followed the best promptings of his heart by going to Laura and seeking from her, whose gentle nature and calm, clear understanding could give him the counsel and comfort he most needed, advice as to what he ought to do. In the presence of Laura he discovered, at last, that he did not love Blanche.

Though Laura urged him to keep his word to Blanche and to lose no time in telling that young lady he was prepared to carry out his promise, we may have reason to think she was not without hope that Blanche herself might settle the matter differently, for Laura had now come back to something of her old girlish admiration for the splendid Pen, and who can tell what her hopes were at this crisis of his fortune?

Events soon happened that decided the lives of many with whose fortunes we have been concerned. The sudden death of the wealthy brewer, Foker, and young Harry falling heir to £15,000 a year, had a great effect upon the romantic heart of Miss Blanche Amory, who had no hesitation in giving Pendennis his dismissal when he placed himself in her hands. She was now to become the wife of the wealthy young brewer, and great were the preparations at Clavering Park for her wedding.

BLANCHE AMORY LOSES A HUSBAND BY ACTING DISHONESTLY

Just then Pendennis discovered that Blanche's disreputable father, the ex-convict, was hanging about the neighborhood, evidently bent on blackmail. Telling her of this, he urged her to let her future husband into her secret; but, afraid of losing Harry Foker and his fortune, Blanche thought it better to keep the matter quiet until she had been married. Unfortunately for her, she could not keep her drunken parent quiet, and that person getting into a scrape, the news reached Foker, who, suspecting that Blanche had known the secret all along and kept it from him, flew into a righteous rage and betook himself far from Clavering Park.

"I would have taken you, whatever you were," he said, in his last meeting with Blanche. "I have loved you with all my heart and soul. But to think that you have been playing with me and cheating me!"

And so it happened that, instead of a brilliant and fashionable wedding at Clavering Church, a very simple ceremony was there observed one day, the bride and bridegroom being—Miss Laura Bell and Mr. Arthur Pendennis.

ARTHUR PENDENNIS AS A HUSBAND AND A FATHER

"And what sort of a husband would this Pendennis be?" many a reader will ask, doubting the happiness of such a marriage. The querists, if they meet her, are referred to that lady herself, who, seeing his faults and wayward moods, seeing and owning that there are men better than he, loves him always with the most constant affection. His children or their mother have never heard a harsh word from him; and when his fits of moodiness and solitude are over, welcome him back with a never-failing regard and confidence.

THE NEXT FAMOUS BOOKS ARE ON PAGE 3631.

A SECOND TALK ABOUT TREES

CONTINUED FROM 3454

IN our first talk about trees, we spoke of their beauty and their use to mankind and the world; but they have one beauty of which we have not spoken and that is the beauty of friendliness. Perhaps you have never thought of a tree as a friend; but think of what the loneliness of a land without trees would be like. When we see a farm house or cottage in the country without the grateful friendly shade of trees about it, we immediately think of a man without friends. When we go back after an absence of years to a place that we loved, the first thing we remember is the trees. When we meet at a turn of the road an old oak that we loved perhaps in childhood, or come within sight of a couple of poplar trees on guard at the gate, we feel we are at home. When our thoughts go back to our early homes, we think first of all of the trees that we loved, the row of elms that shaded the road, a graceful birch tree standing out against the sky, a silky beech in the heart of the woods, or the maple trees that shaded the village street.

We love the trees in all their moods. Sometimes we are at a loss to know whether to admire them most when they are covered with a tender veil of green in springtime, or with the rich verdure of summer; when they toss their arms about in protest against the autumn gales which strip them of their leaves, or stand gaunt and silent against the winter storms. They have another aspect that no painter, however skilful with his brush, has ever yet been able to paint. When the year begins to turn and the sap stirs in the branches, before ever there is a hint of green, and the snow still lies on the ground, a beautiful purple tinge creeps over the trees, and the winter landscape takes on a brightness that it lacked before. It is as though a grim staunch friend, who had stood by us through adversity, turned with a smile and said: Take courage, the worst is past, brightness and joy are coming to you again.

THE LONELINESS OF THE PRAIRIE COUNTRY WITHOUT TREES

When the first settlers went out to the prairie sections of the West they complained of the loneliness of that great land with not a tree in its vast open spaces. They missed the companionship of the trees to which they had been accustomed in their Eastern homes, and did not feel satisfied until they had persuaded them to grow about their homesteads. Daniel Boone spent months in the woods, all

alone except for his dog and the trees. He was not lonely because he had his dog and the trees that he loved surrounded him.

When the founders of the American nation came from Britain, forests stretched out before them on every hand. In the forests they found many trees that were strange, but also many that were like those that they and their forefathers had loved in the places where they and generations of their families had lived. In the woods grew oaks of many kinds, graceful elms and sturdy beeches. But there were special trees that they loved, that grew about their old homes. They missed the familiar flowering trees that make the English countryside so beautiful in springtime, and the fruit trees that grew in the orchards that their fathers had planted. Seedlings and cuttings were brought over to this country. Before a generation had gone by some of them had taken root as firmly as the men and women who brought them, and for whom they had helped to make the new land home.

MANY AMERICAN AND EUROPEAN TREES ARE CLOSELY RELATED

In another place you will find some beautiful pictures of native American trees, but in these pages we have shown pictures of British trees. Some of these have become naturalized and we oftentimes forget that they are not native to the soil. If you compare the pictures, you will see how strong a resemblance and how close a relationship there is between the trees of Europe and America, and though some mistakes were made in the early days, in naming the native trees, the errors were few. Our holly tree, for instance, cannot be mistaken for anything but a cousin of the British holly, though its leaves are not so shiny, and its bright red fruit is differently arranged. The rowan tree of our hillsides differs from the Scottish tree only in the color of its berries. The plane tree of Europe is distinguished from our buttonwood only by a difference in the leaves, and the fact that it has one fruit-ball instead of three.

Many trees in the forest outlast the lives of generations of men, and seem to link them up together. What child in this whole country would not thrill with righteous anger at hearing that an attempt had been made to cut down or destroy the beautiful trees that Washington planted himself and loved and cared for. Perhaps the yew tree which is pictured here gave bows to the men who fought at Crecy, or even to the Saxons to defend themselves against the Norman invader.

THE LOVE OF THE POETS FOR THE TREES AND WOODS

All the British poets loved the trees of their island home and wrote of them. If you read the tales of adventure in the Morte d'Arthur you will see how large a part the woods played in the imagination of the poets of the time when it was written. Spenser imagines the fair Una and the Red Cross Knight on a journey through the forest. Shakespeare placed some of his loveliest scenes in the forest. When Milton wrote of the Garden of Eden, "a garden planted with the trees of God," he made of the approach to the garden a beautiful picture:

> "Cedar and pine and fir and branching palm,
> A sylvan scene, and as the ranks ascend,
> Shade above shade, a woody theatre
> Of stateliest view."

But none of the trees appealed to the Englishman like the oak tree, while in the Scottish legends the rowan tree, and in Irish folk lore the thorn tree play a large part. Other trees have appealed to the imagination of poets of the British Isles, but these are the most loved, and of the three the oak tree, "the monarch of the wood," who "has stood for a thousand years," is most often spoken of as a person. Dryden says:

> "The monarch oak, the patriarch of the trees,
> Shoots rising up and spreads by slow degrees.
> Three centuries he grows and three he stays
> Supreme in state, and in three more decays,"

while to the poet Keats the oaks were "Green-robed Senators of mighty woods."

Southey thinks of the holly tree as a friend who stays with us when fortune frowns, and asks what in wintry weather "is more cheerful than the holly tree?" while Byron in one of his dark moods thought of the cypress as "the only constant mourner o'er the dead!"

We can find many references to trees in the poets, and these quotations may help you to find, for yourselves, the best-loved tree friends of your favorite poets.

THE NEXT STORY OF NATURE IS ON PAGE 3663.

The slender leaves of the Scotch pine remain on the tree for two years before they fall. The first year they are a light bluish green in color, which gradually changes to dark green. The fallen leaves kill other plants

This sturdy tree, known as the Scotch pine, is familiar about old homesteads. Its pollen or seed, falls in large quantities and looks like sulphur. When, in 1902, people found the pollen lying thick on the ground, they wrote to the newspapers to say that sulphur from the volcanic eruption at St. Vincent had fallen in England.

THE HOLLY WITH THE PRICKLY LEAVES

The white flowers of holly are small, but, like the red berries that come later, they are very conspicuous because they grow together in such great numbers.

Cattle like young holly leaves, and on the lower branches spines develop for protection. Higher up, out of reach of animals, the leaves have no spines.

We know holly best as a bush, but it grows to a tree, forty or fifty feet high, and when covered with red berries is a magnificent sight. This is a European holly-tree, on which the berries grow in clusters.

THE WILD CHERRY OF THE COUNTRY-SIDE

The leaves of the wild cherry-tree are a deep blue-green in color, and grow on slender branches. When the tree is in bloom, it is covered with delicate cup-shaped flowers, that later produce myriads of cherries.

This is a fine specimen of the wild cherry-tree, for usually it is a mere bush. The luscious cherries of the orchards are descended from the wild cherry. Many of those grown in this country were originally imported.

THE WILD PEAR-TREE OF THE WOODS

The leaves of the wild pear are, in shape, like those of the wild apple, and their under-surface is downy.

The white flowers are clustered in groups of five, and the fruit that comes from them is rough and uneatable.

The pear-tree, which is known to us only in its cultivated state, grows wild in Europe and western Asia. The wood has a very fine grain, and, when stained black, makes an excellent imitation of ebony.

THE WILD APPLE-TREE'S DAINTY BLOSSOM

The leaves of the wild apple-tree vary very much in shape, as may be seen here. They are smooth on the upper surface, but sometimes very downy underneath.

Few flowers that grow on trees present a more beautiful sight than the clusters of wild apple blossoms, with petals delicately tinted with pink.

We all know the crab-apple tree, which is so beautiful in spring when it is covered with a mass of exquisitely beautiful pink blossoms, with a spicy fragrance. In some parts of the country cider is made from crab-apples, and crab-jelly is a favorite delicacy All efforts to cultivate the wild crab-apple tree have failed.

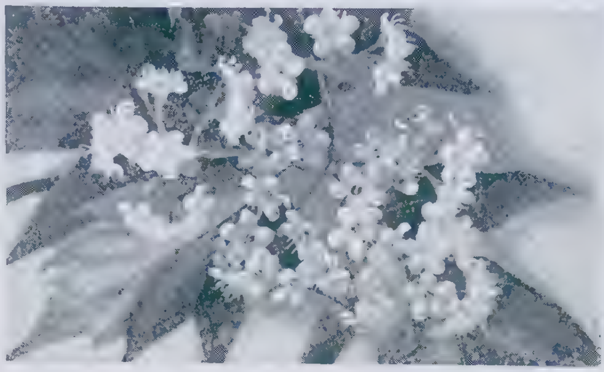
THE WHITE-BEAM WITH THE RED BERRIES

The white-beam's leaves are toothed at the edges, and the under-surface is covered with white down.

The white-beam's loose clusters of white flowers produce scarlet berries, called in the North chess-apples.

The white-beam is one of the less known trees, but it is useful, as the English use its hard wood for making cog-wheels in machinery where iron is not suitable. Birds and squirrels are fond of the scarlet berries.

THE WILD SERVICE-TREE OF THE HEDGE

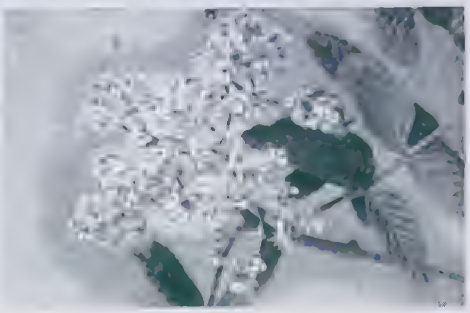


The flowers of the white-beam on page 3530 are remarkably like those of the wild service-tree ; in fact, the one blossom is often mistaken for the other. The leaves of the two trees, however, are different.

The wild service-tree is very common in the south of Britain, and may be seen in the neighborhood of London. But, though ornamental, it does not often grow very high. The greenish-brown berries are sold in fruiterers' shops, for, though rough and acid when fresh, they are pleasing when mellowed by frost

THE ASH-TREE THAT WAS USED FOR LUCK

The leaf of the mountain ash is like that of the ash, and thus it received its name, but really it belongs to the apple tribe. This tree was once thought to bring luck.



We can see how different the delicate white flowers of the rowan are from the flowers of the true ash. The flowers are followed by bright scarlet berries.

The mountain ash will grow almost anywhere in the poorest soil. Its other name of rowan means "charm." We find the native rowan on hillsides and in rocky woods, while the tree we so often see in cities is generally the European rowan. The rowan-tree in full bloom makes a charming nature picture.

THE HAWTHORN'S FRAGRANT BLOSSOM

Hawthorn rarely grows larger than a bush in places where cattle have free access, because the animals are very fond of eating the leaves and young shoots.

The hawthorn flower is the fragrant blossom that the English call the 'may." It is usually white, though sometimes it will be found tinged with pink.

This is a picture of the famous English hawthorn, the " may " of the poets. Unlike our hawthorns the odor of its flowers is exquisitely sweet. It has been introduced into this country and is prized not only for its sweetness but for the wild beauty and grace of the tree. In the British Isles it is often used for hedges.

THE BLACKTHORN THAT GIVES US SLOES

The white blossoms of the blackthorn produce the sloe berries that are used for adulterating cheap wines. Years ago, when tea was dear, old country people made tea from blackthorn leaves.

Blackthorn is not called by this name because its flower are darker than those of the whitethorn, or hawthorn, for they are whiter, but as the bark is nearly black. Probably our plums are descended from this tree.

THE ELDER, THE TREE OF THE WAYSIDE

The elder leaf is divided into five, seven, or nine oval leaflets. Here we see, not twenty leaves, but only four.

The cream-colored flowers of the elder grow in clusters of five, and when dried they have a very pleasing odor.

The elder is the tree of the wayside, and though on good, moist soil it grows twenty feet high, it is rather a bush than a tree. Country people make wine from the berries, and medicine from the flowers. Evelyn, the writer, calls the elder "a cure for all ills." Boys like the elder because the branches make fine pea-shooters.

THE PLANE-TREE OF CITY AND TOWN

The broad leaves of the plane give the tree its name, for " plane " means " broad." The leaves are like those of the maple, but the two trees are not related. The flowers grow in little balls like old-fashioned buttons.

The plane is the most long-suffering of trees, for no amount of smoke and dirt seems to affect it. Even when the bark and leaves are covered with soot, the tree still flourishes, and this is why it is so useful for planting in city streets The plane-tree shown in this picture has been introduced from Europe.

THE YEW-TREE OF THE CHURCHYARD

The leathery leaves of the yew, which grow very closely together, are poisonous to cattle and human beings, although the berries are not harmful. When a yew hedge has been cut, and the leaves thrown aside, cattle have been found dead, having eaten the leaves. This picture shows the leaves and the small male flowers.

The yew-tree grows to a large size, and lives to a great age. The famous yew-tree which grows in the cloister of Muckross Abbey, on the Killarney Lakes, was planted when the abbey was built in the fifteenth century, and there is a tree in Perthshire in Scotland which is nearly two thousand years old.

THE NEXT STORIES OF NATURE BEGIN ON PAGE 3663.

CITIES AND PORTS OF BELGIUM & HOLLAND

There are some very handsome cities in Belgium, of which Brussels, a miniature Paris, and Ostend, the Belgian Brighton, easily take front rank. The Palais de Justice, or law courts, at Brussels, is one of the finest modern buildings in Europe, as may be seen from the picture. Before the Great War Antwerp was one of the greatest commercial ports in the world, and had an annual trade of over a million dollars. The commercial ports of Holland, Amsterdam and Rotterdam, too, are among the most important seaports of the world.

In Holland the waterways cut up the land in all directions, and the landscape is everywhere dotted with windmills, that are largely used for the purpose of pumping and draining the land.

HOLLAND AND BELGIUM

CONTINUED FROM 3348

THE highest land in Europe, and the lowest, are linked together by the River Rhine. Far away amid the mountains of Switzerland it starts on its long journey, leaping like a merry child, till it passes into the quiet waters of Lake Constance. Then, with growing strength, it dashes and roars, as it tumbles over the rocks at Schaffhausen, and then flows, in staid middle life, rapidly and steadily north, useful and strong and beautiful, for many, many miles through Germany. After passing the grand gate of the Seven Mountains near Cologne, it goes slower, as if age had come upon it, and at last, stretching out weary arms, it seems to be blindly searching for the sea, in which to end its course in peace.

The triangle of low land on the North Sea between France and Germany—lying in the grasp of these arms of the Rhine and about the lower courses of the Meuse and the Schelde where the great north plain of Europe is narrowest—has been known through history as the Low Countries, or the Netherlands, nether meaning lower. Small as the district is—about half the size of Nova Scotia—it comprizes two distinct countries, occasionally united under one rule through the centuries. Holland, the hollow or marshy land, the northern and larger half, with its ragged coast, lies chiefly in the Rhine delta. Belgium, to the south, has less than fifty miles of coast, and consists of the lowlands drained by the Meuse and Schelde, and the highlands of the Ardennes, wooded hills as high as the Berkshires.

If we go to Europe by a steamer which will land us in England, we may enter Belgium at Ostend, a seaside resort which is only a short voyage from Dover. Ostend has a beautiful beach and a good harbor. Railways run along the coast and through the country, and we may make the town our starting-point for a tour round the fine old cities which lie closely dotted over the fertile plain. The cities are the pride of the home-loving Belgians, and they speak vividly of the past of this brave and industrious people.

If we prefer a longer sea voyage we may enter Belgium by the estuary of the Schelde to Antwerp, a very great port, connected by rail and canal with not only the rest of Belgium, but with the industrial towns of the Lower Rhine, about a hundred miles away, and easy of access to the places across the ocean which send Europe the raw material that it cannot grow itself. Bruges and Ghent, also deeply interesting old cities, are connected with Ant-

werp by canals. Brussels, the capital, is in the centre of the kingdom. In the old days it was so gay, and full of fine shops and handsome buildings, that it was often called "Little Paris."

It is an easy journey to pass from Brussels to Holland, but if we go direct from England to its shores, we can land either at Flushing, on an island on the north bank of the Schelde, or at the Hook of Holland, on the north side of the Meuse, which leads to Rotterdam, the great port of Holland. It is here that the great ocean liners stop. The channel of the Meuse is the chief entrance to the Rhine.

THE DUTCHMAN'S BATTLE WITH THE SEA THAT HAS LASTED A THOUSAND YEARS

Between Flushing and the Hook are the numerous muddy islands formed by the sediments brought down by the great rivers, so here we have some of the earth of Switzerland, Germany, and France. North of Rotterdam are the Hague, the beautiful capital of Holland, Utrecht, Leyden, and Haarlem, so famous in history, and Amsterdam, Holland's largest city of commerce, on an arm of the Zuyder Zee. The Zuyder Zee is the youngest sea in the world, for it was formed only about 600 years ago, when the water burst in over the land, sweeping away villages and farms and the poor folk who lived in them. The greater part of Holland is below the level of the North Sea.

There is an old Dutch proverb: "God made the sea, but we make the shore." For more than a thousand years the making of that shore has been the first duty and thought for those who, living in the land, wished to protect it, and enlarge its borders, against the storms and tides that dash against it.

As we travel through Holland to-day, we are astonished at the engineering skill that has grown through the centuries from perpetual battle with the water.

A LAND WHERE THE FISH SWIM ABOVE AND THE BIRDS FLY BELOW

Let us stand on one of the great dykes, or sea walls. It is perhaps sixty feet high, and broad enough at the top for a carriage door, bordered with trees and buildings. The sea laps quietly, though it may rage and roar to-morrow, not far below the level of this road, and boats come alongside to little piers and quays; but the other side slopes deep down to the green meadows, so that we on the dyke can see down the chimneys of the houses nestling on them below, and the fish on the one side are higher than the birds on the trees on the other. Very strong, built of stones and cement and willow boughs, are these walls which push back the ocean, and constant care is needed to see that there is no leak, and that the various gates and sluices are in perfect order.

There are strong walls, too, round the lakes and on the banks of the rivers that become flooded when the snow melts in the distant Alps; and everywhere are canals and ditches cut to regulate the flow, and to help the land to keep its head above water. In many places, continuous pumping has to be carried on, and this is largely done by the windmills that are such a feature of the country, and by pumping engines. For centuries all the pumping was done by picturesque windmills, but now their place is being taken by modern steam pumps, which can do more work in a shorter time.

Besides pumping and draining, the windmills saw up wood and grind corn. Many lakes are formed by the draining of the marshes, which has been done with enormous toil and skill; and as we pass from the Hague to Haarlem in the train, we see one of the largest beautifully green and fertile *polders*, as the drained marshes are called.

A CITY BUILT ON ISLANDS, WITH CANALS IN THE STREETS AND 300 BRIDGES

If our visit is in the early summer, the reclaimed land will be brilliant with the lovely bulb flowers for which Holland is so famous. In most of the towns, canals run through the streets. Amsterdam, for instance, is built on almost as many islands as Venice, and the canals are crossed by 300 bridges. The soil is so moist that, generally, houses have to be built on a foundation previously made firm by driving in a number of piles. Erasmus, the great Greek scholar, who lived at Rotterdam, and did so much to prepare the Reformation, had this in his mind when he said that he knew a city in which people lived like crows on the tops of trees.

Holland is so flat that there is very small need for danger signals for motorists. If we mount the towers of any of the fine old cathedral churches we can see all round for miles, right away to the

distant horizon. And a bright and wonderful view it is on a sunny day—quite dazzling, for the water shines everywhere, and so do the brass weather-vanes and the steel railway lines; and even the sails of the boats on the canals gleam against the green of the fields. It is strange to see sails mixed up with trees, especially when the rivers or canals are higher than the fields. And over all is the tender, delicate light, which Dutch artists know so well how to paint in their pictures.

If our visit to Holland is in the winter, a very different scene meets our eye. Instead of the vivid green, a mantle of white rests over all, and the gleaming waters of the canals and ditches are frozen hard and are covered with skaters—doctors going to their patients, children to school, laborers to their work. The Dutch and the Fen-men are among the best skaters in the world and the Fen counties of England are very like Holland. We have seen many beautiful pictures by great Dutch artists, such as Rembrandt, Rubens, Franz Hals, in the great art galleries, but in the cities of the Netherlands there are ten times as many, illustrating, with the relics in the museums, the life and history of the country, the great scenes which took place through the centuries, the portraits of the leading men who made or marred its happiness, as well as the pictures of home life in palaces and cottages in days long since passed away.

A SNAPSHOT IN A STREET OF HOLLAND

Although the people of Holland are industrious, no matter where we go, we can see the men standing about, dressed in their big, balloon-like breeches, smoking or talking.

Let us now, for a while, leave the Belgium of our own times, and the Holland so carefully wrested and guarded from the ocean, and glance at the story extending over 2,000 years, of the struggles by which the Netherlands have not only in the end kept their small corner of Europe independent, but which have so strengthened and educated the people that, for centuries, they have been counted among the world's teachers in most of the matters that are worth knowing.

The Low Countries formed but a dull, damp district, shut in by the gloomy depths of boundless forests, when we first catch sight of them in the searchlight thrown by Roman civilization. For countless ages the rivers, which, we see, are very numerous all over the land, had been steadily bringing down slime and mud, and the wind and tide had been occasionally dispersing and destroying the banks thus formed. The early Celtic people who chose these shifting swamps for their home lived on the wooded islands at the mouth of the Rhine. The bravest among them were the Belgæ, who gave their name to the country where their descendants still live. Before the Roman invasion, some of the Celtic tribes had been conquered by Teutonic tribes, who settled in the country. Amongst them the Batavians and the Frisians were celebrated for bravery and love of freedom and their determination to protect the land on which they dwelt. The Batavians proved of great use in the Roman armies.

In the fourth century, the Frankish tribes came swarming over the Rhine, and by degrees they absorbed the Frisians and the Batavians and the

rest of the tribes living in the morasses and low plains, till at length all the country fell under the rule of the great Charlemagne. He left the people their native customs, and put chiefs over them as his delegates, whom they had to obey. Part of Charlemagne's plan was to give wealth and power to the bishops of the newly Christianized tribes, and for nearly a thousand years these prince-bishops were very important. After Charlemagne's death the great empire broke up, and under the weak rulers that followed, the independent nobles became ever stronger. There were the Bishops of Utrecht, where was the first Christian Church, the Counts of Holland—Holland being originally a province, which later gave its name to the country.

The Dukes of Brabant and the Earls of Flanders—William of Normandy took his bride from Flanders—were very important nobles, as well as the lords of Hainault, which also furnished an English queen, of whom we read elsewhere. Other small states were Guelderland and Friesland. The old laws of the Frisians declare that the race shall be free, as long as the wind blows out of the clouds and the world stands, and this principle has always been kept in view even in times of overwhelming trouble.

THE RISE TO WEALTH AND POWER OF THE CITIES OF THE NETHERLANDS

These were the bad old feudal days, when the nobles were for ever quarreling amongst themselves, and, according to their opportunities, doing their best to take away the liberties of the people. The prince-bishops gained more and more power over men's minds, till no one dared to think for himself.

We know how the rise of important towns has always helped on the cause of freedom, and though the towns in the Netherlands are not quite so old as some in France, Italy, and Germany, most of them date from early times. When trade was set moving by the impulse of the Crusades, the towns of the great north and south route began to rise from small beginnings to wealth and power. In the thirteenth to the fifteenth century, the towns of the Netherlands did much business with the towns of the famous Hanseatic League, of which we read on page 2554. In the fourteenth century there were over 3,000 woolen manufactures around Malines, now the centre of the Belgian railway lines; Ghent had 40,000 weavers, and the goldsmiths of Bruges were numerous enough to form a regiment by themselves in time of war. The towns of Delft, Haarlem, Rotterdam, Amsterdam, were all growing, though often devastated by the endless quarrels of landowners and townsmen.

HOW ENGLAND GREW WOOL FOR THE FLEMISH LOOMS

It was at this time that England grew so much wool for Flemish looms. Linen, too, of various kinds was added to the manufactures. Holland, a stout linen material often used for children's clothing, still bears the name of the country where it was originally made.

But all the time when the trade and industry were growing, amidst constant scenes of violence and fighting in the streets of the flourishing towns, the struggle against the elements for possession of the country was ever going on. Did the fierce winds heap up the sandhills on the shore, the Netherlanders planted coarse grass to bind it together to make a rampart against further encroachment. Did the river overflow its banks, they were strengthened and heightened, and so by degrees, by patient trial and endeavor, that wonderful skill was attained in building dykes to withstand even the onward rush of the stormy tide, and in making canals and draining lakes. Sometimes, as we have seen, the giant ocean had his way. It was in the thirteenth century that he rushed inland and formed the Zuyder Zee. For years past plans have been maturing to drain this great body of water and restore the land to cultivation.

THE MAKING OF THE DUTCH RACE AND ITS GREAT FIGHT AGAINST TYRANNY

All this effort for generations produced a wise and determined race, few in numbers, and living in a small country, yet able to resist in the fifteenth and sixteenth centuries the fierce tyranny of the most powerful of the sovereigns of Europe.

For a dark cloud began to grow over the Netherlands when by seizure, purchase, succession, marriage of heiresses, the most considerable of its states passed under the sway of the Dukes of Burgundy. We read on page 2988 how these dukes wished to annex Switzerland as well as

PEOPLE OF THE NETHERLANDS LONG AGO

This picture, by an old Flemish master, shows the dress of Dutch ladies in the middle of the 17th century. The four ladies whose portraits we see were the managing committee of the hospital for lepers at Amsterdam.

Here we see the child life of the Netherlands in the days when the Dutch were at the height of their prosperity.

The houses of the old Flemish merchants were plain, roomy dwellings, each entered through a courtyard.

This painting of a burgomaster, or mayor, with his family, shows the dress worn by the Dutch people of the better class in the 17th century. We see the costumes of a child and of men and women, old and young.

the Netherlands and make one long independent kingdom between France and Germany. The crafty Louis XI. had very much to say about this, and was at constant warfare with Duke Charles the Bold. From the daughter and sole heiress of this bad as well as bold man were wrested charters of privileges, commonly called the Great Privilege—afterwards the foundation of greater liberty by the first regular assembly of the States General, the members of which were sent from the provinces and great cities of the Netherlands.

This young duchess, Mary, married Maximilian of the Hapsburg family, Duke of Austria, and later Holy Roman Emperor. Their son, Philip, succeeded to his mother's dominions, and he married Joanna, the daughter of Ferdinand and Isabella of Spain, elder sister of Catherine, wife of Henry VIII. of England.

Their son was the famous Charles V., who gathered into his hand the rule of the Netherlands with that of Spain and Austria. All these countries hated one another, and the liberties of the Netherlands were in terrible danger from a prince who firmly believed that he had the sole right of disposing of the persons and lives of his subjects, as well as settling their faith and religion.

THE SPANISH TYRANT WHO PERSECUTED THE PEOPLE OF THE NETHERLANDS

Charles, in spite of his wide empire, was always in want of money, and he required the rich cities of the Netherlands, especially of Ghent, to furnish it whenever he chose to ask for it, and when denied, took away all the charters and rights of those who opposed him, and fined and executed the citizens. Hard as this was, especially when trade from different causes did not bring in so much wealth as formerly, it was not to be compared with the suffering brought upon the country through Charles' tyranny in matters of religion.

We know how the teaching of Luther raised a storm in Germany and in England. That of Calvin, another reformer, powerfully affected France and the Netherlands, and in these countries the rulers hated and feared the Protestants not only because their beliefs went against the supreme power of the Church, but because they denied the absolute power of the rulers themselves; and so as the Netherlanders became more and more convinced that the Reformation was right, and bent all the strength of their determined natures to uphold it, the more bitter became the persecution of those in power, in order to stamp it out. Charles established the terrible Inquisition in the Netherlands, and some of the reformers were burned under his orders.

A MAN WITHOUT PITY, WHO SENTENCED A WHOLE NATION TO DEATH

His son, Philip II., carried out his father's plan only too well, and when the Dutch rose in rebellion and destroyed many churches and broke up the monasteries, he sent the Duke of Alva, a most clever soldier, and a man absolutely without pity, to suppress them. Almost the entire population of the Netherlands was sentenced to death without even the form of a trial, and people were suddenly seized and put to death without farther warning, till there was not a family who was not bereft.

A national hero rose up at this time, William the Silent, Prince of Orange. His ancestors had done good service to the House of Burgundy, and William was brought up under the eyes of Charles V. When the worn-out emperor laid down all his crowns to go into a monastery, it was on William's arm that he entered the great hall at Brussels, capital of the Duchy of Brabant, where the brilliant ceremony of renunciation took place.

William very soon ceased to be friends with Philip of Spain, though for years he was called his lieutenant; and after he openly became a Protestant he was the leader of the opposition to the bloodthirsty Alva. The patriots called themselves, at first in grim joke, the Beggars. Sometimes they won, especially at sea, sometimes the Spaniards had the best of it, and the struggle went on for many years under different governors and generals.

HOW THE MEN OF LEYDEN CUT THE DYKES AND SAVED THEIR CITY

Stories of the heroism shown in this war of independence are told of nearly every town, every acre of the Low Countries. The sieges of Haarlem and of Leyden are amongst the most memorable. Leyden held out a whole year, except for a brief respite, and the

EVERYDAY LIFE IN HOLLAND TO-DAY

The picturesque life of the Dutch people to-day is well illustrated in this beautiful picture by Mr. G. H. Boughton, R.A., showing a number of Dutch girls weeding a stone pavement by the side of a wide canal.

The homes of the Dutch are very quaint and clean. The household crockery is always proudly displayed,

There is no mistaking the national costume of Holland, as seen in the caps and dresses of these Dutch girls.

Holland's splendid naval history, and the great fight of the people to keep the sea from invading their country, prove that the Dutch are by natural instinct masters of the waves. The Dutch children are, from childhood, at home in the water, as may be seen from this picture of boys and girls playing in the sea.

The photographs on these pages are by the Photochrome Co., F. Hanfstaengl, and others.

heroic defenders were reduced to awful starvation, but still would not give in. There were fights on the slippery ice in the bitter winter. As a last resource, the dykes were cut, and the water flowed over the hardly won fields, sending the Spaniards away in haste lest they should be drowned; but now the ships that had been waiting almost within sight could come right up to the walls of the town, bearing the precious food to the starving inhabitants.

After a while the provinces of Holland and Zeeland united; and when they felt strong enough they took the important step of renouncing in words the authority of Philip. Elizabeth of England, of whom we read on page 862, helped them cautiously. One of the bravest of the English volunteers who pressed across the North Sea to help the Netherlanders was Sir Philip Sidney, whose story is told on page 475. It was he who, when dying, handed the precious cup of water, untasted, to another wounded man, saying: "Thy necessity is greater than mine."

HOW THE CHILDREN CRIED IN THE STREETS WHEN WILLIAM THE SILENT WAS KILLED

But scenes of war, of sacking fine cities, of senseless cruelty in persecution, could not last for ever, and after several unsuccessful attempts at union among the provinces, and at making peace with Spain, Dutch independence was declared in 1581. William the Silent, "Father William," as he was affectionately called, was the head of the new republic. It was nearly seventy years before Spain gave up all claims and titles, and acknowledged the complete independence of the Dutch.

Three years after the Declaration of Independence, the wisest man in Holland was murdered by a Burgundian hired by Spain. As long as William the Silent lived he was the guiding star of a brave nation, and when he died the little children cried in the streets.

War still went on under his son, Maurice, and the southern states, with their great towns of Antwerp and Ghent, and many others, were reduced to obedience to Spain for many years after the northern states became free. Protestantism had been stamped out, the brave and clever Flemish workers had been driven away to Holland or to England, to their great and lasting benefit, and the subdued country lay in poverty and exhaustion. Ten years after the rout and ruin of the Armada, started by the fire-ships and the storm off the coast of Flanders, Philip II. died, after a reign of 42 years.

PHILIP THE SECOND, ONE OF THE GREAT DESTROYERS OF MANKIND

He has been called the destroyer of mankind, for he sacrificed very many lives to his ambition and his belief. We can think of him sitting at his desk in his palace in the Escurial, planning the affairs of the world—the oceans were to him but Spanish lakes—coolly arranging assassinations and executions; squaring his money matters—his bribes and his losses. And then his long day was done.

It was in 1600 that Queen Elizabeth formed an East India Company to trade abroad, as all commerce had been so hindered by the ambitious plans of Spain. Holland followed suit two years later. Much money was spent on fleets and ports and factories; and from these days the sailors of Holland—trained in the wild fishing-grounds of the North Sea—were to be found all over the world taking possession of the Spanish and Portuguese colonies, and often hotly contesting with the English. New Amsterdam, afterwards New York, was founded on this side of the Atlantic, and many old New York families are proud of Dutch descent. The city of Batavia was founded in Java, called after the old island province, the kernel of the mother country, and the New Batavia is the headquarters of the Dutch colonial empire to this day. Amsterdam and Rotterdam and all the old cities now revived, as trade flowed in with the arrival of ships laden with "sugar and spice, and all that's nice," at the busy quays.

HOW THE LAKES AND MARSHES WERE CHANGED INTO RICH MEADOW LANDS

As soon as peace gave leisure, pumping works were established to drain lakes and marshes, and the rich meadow land thus gained fed the finest cattle in Europe. Dutch butter and cheese have long been famous all over the world. Other uses to which the land gained from the sea was put were to grow roots for food and various kinds of hay, besides bulbs of beautiful flowers like tulips. The Dutch taught all Europe

how to garden and farm. At this time Holland became the printing-house of Europe, sending out thousands of books of history and travels, law and medicine. Trades, too, such as diamond-cutting—for which Amsterdam is still famous—gave employment to very large numbers of skilled workmen. In the seventeenth century the rivalry between the Dutch and English on the high seas came to a height. There were many famous admirals, many brave seamen on both sides. Van Tromp and De Ruyter on one side and Blake and Monk on the other were famous leaders. For years they tried to sweep each other off the narrow seas. London was in a panic when De Ruyter sailed up the Thames in the inglorious days of Charles II., and sometimes the obstinate sea battles lasted for three or four days, for both sides belonged to a stock that never knows when it is beaten.

HOLLAND AND BELGIUM, SHOWING THE RIVERS AND TOWNS

In the age of Louis XIV., France made several conquests in the Spanish Netherlands which had passed to Austria, and Holland, too, had its share of French aggression. To save the country, the dykes were opened. Later, the waters froze, and when the French troops were marching over the ice to attack the Hague, a sudden thaw alone saved the country from destruction. The head of the republic at this time was the great-grandson of William the Silent. His name was also William, who married Mary, daughter of James II. of England. When England could no longer bear the tyranny of the Stuarts, William, with his wife, was invited over to be king in James's place. He helped to restore old laws and liberties, and to strengthen the position of the reformed religion. In the eighteenth century the importance of the united provinces of the Dutch Republic became less than it had been during the seventeenth, and there were many disturbances in the country, which led to the interference of the King of Prussia. But the French Revolution was at hand, and before long the map of Europe was completely changed, and bewildering changes came to the Low Countries, both north and south. The seven united provinces were turned into the Batavian Republic, and a few years later Napoleon turned it into a kingdom for his brother Louis. But that did not last long. He soon took his brother away, and joined Holland and all the other provinces to

France. "They are but the sediments of French rivers," said he, "and therefore clearly belong to me." The decisive battle, about which we read elsewhere, which confirmed the downfall of Napoleon, was fought at Waterloo, near Brussels.

THE BIRTH OF THE MODERN KINGDOM OF BELGIUM

When the Congress at Vienna remade the map of Europe, the whole of the Netherlands was joined into a single kingdom under another William, Prince of Orange, who was given the title of king of the Netherlands. But the northern and southern provinces did not agree about religion, and other matters, so, in 1830, they revolted, and the old Spanish Netherlands became the kingdom of Belgium, under a German prince, Leopold of Coburg. His great-nephew, who paid a visit to the United States some years ago, is now king, with the title of Albert I, King of the Belgians. In the year 1900 he married Princess Elizabeth of Bavaria and both of them are much beloved by the people of Belgium.

HOW THE KINGDOM OF THE NETHERLANDS IS GOVERNED

After the division of the Netherlands, the northern provinces, which we know as Holland, went on as the kingdom of the Netherlands. William I died in a few years, and was followed by his son William II. William II had no son, but as the constitution provides that the kingdom may be ruled by either a king or a queen, when he died he was succeeded by his daughter Wilhelmina, who is now queen. She has no son and the heir to the throne is her only daughter, the little Princess Juliana.

In the government of the country, she is assisted by the legislature, which is known as the States General, composed of two chambers, the First, or Upper Chamber and the Second, or Lower Chamber, and a Cabinet of nine ministers, which is responsible to the legislature. Until recently, only tax-payers, householders, or owners or tenants of houseboats could vote, but, in 1918, an amendment to the constitution was made, which introduced universal suffrage. Members of the Lower Chamber are elected for four years. Members of the Upper Chamber are elected for nine years, but a third of their number goes out of office every third year. The queen may dissolve either chamber, or both, but in case she does the new legislature must be ready to meet in two months. The country is divided into eleven provinces, which have local government, and these provinces are subdivided into communes, each of which has a council and mayor.

THE RICH TRADE OF HOLLAND AND HER GREAT MUSEUMS

From what you have read of the country, you will not be surprised to hear that, with the exception of a little coal in one of the eastern provinces, Holland has no minerals. The country cannot produce enough grain for the use of the people, but the rich pastures support large well-kept herds of cattle, and quantities of butter and cheese are exported. The fisheries are very profitable, and we have all read of the lovely tulip and hyacinth fields of Holland, from which we get our finest bulbs.

Holland has rich colonial possessions in the East Indies which supply her with tobacco, without which no Dutchman can exist, and with coffee, sugar and spices. The wealth of the country comes from its commerce, and if you look at the map, you will see how well suited it is to be a commercial country. Its position on the North Sea makes it one of the gateways of Central Europe, and its numerous waterways provide an easy means for carrying the products of the East and of the West from the sea to inland towns and cities. Amsterdam and Rotterdam are the chief ports of the country, and the trade of these cities is enormous. Between Amsterdam and the sea, the famous North Sea Canal, about fifteen miles long, cuts through the peninsula of North Holland, and saves the ships from sailing round it.

In the cities of Holland, the story of the past is ever before our eyes. Fine cathedrals, churches and town halls, and buildings of all kinds are like speaking witnesses that connect the present with the past. The museums and picture galleries contain many treasures. At The Hague, as the capital is called, there is a wonderful picture gallery called the Mauritshuis; at Rotterdam there is also a fine museum, and at Amsterdam is the famous Ryks Museum, where we may see many relics of the time when the Dutch navy was the strongest in the world, and the famous admiral De Ruyter carried a broom at his masthead as a token that he had swept the seas.

THE CAPITAL CITY OF BELGIUM

This gives an idea of Brussels, the capital of Belgium. On a hill to the right of the picture is the Palais de Justice, where the chief courts are held. This building, which is modern, was erected in the latter part of the nineteenth century. It is one of the finest public buildings which have been erected in modern times.

This picture shows a corner of the famous flower market of Brussels, which is held in the square called the Grande Place. The beautiful building on the left is known as the Maison du Roi. It was first built many centuries ago, and it was here that the patriots Egmont and Horn spent the night before their execution. The building was badly injured by bombardment in the wars of the nineteenth century, but was carefully rebuilt. For some years it has been used as a museum for objects of historical interest.

WATER, WATER, EVERYWHERE, BUT NOT A DROP TO DRINK

Let us now mount the Cathedral Tower at Utrecht, and as we look over the wide view, at the dykes, the canals, the windmills, the cultivated fields, the busy towns, we think again of the centuries that have passed since the Batavians settled in the island held in the arms of the Rhine.

Holland is one of the most interesting and most amusing countries in the world. Though water is everywhere, there is often none that is fit to drink, and people have to buy it by the pailful, as they often buy some fuel to boil their kettles. From the high dykes frogs can look down on the birds, and in the damp fields, the cows wear coats. Water omnibuses ply for fares on the canals, and coal and peat are brought by brown-sailed boats, which are hitched up to the door, like a horse. The peasants wear beautiful gold ornaments, and costly lace on their heads, and often perch a shabby French bonnet on the top of it. Dogs draw little carts with brass jars full of milk. The brass and copper shine like gold, and everything that can be scrubbed is scrubbed at least once a week, even the big railway stations.

The Dutch, as the people of Holland or the Netherlands are called, are not only cleanly but thrifty. Nothing is allowed to go to waste, and when the Great War in Europe broke out the country was in a high state of prosperity. During the war the country maintained a state of neutrality, but the people showed great kindness to the distressed inhabitants of Belgium and to hundreds of thousands of those who fled from that unhappy country.

THE STORY OF LITTLE BELGIUM AFTER ITS SEPARATION FROM HOLLAND

After its separation from Holland, Belgium became very prosperous. The people, who, like the French, are a home-loving race, did not emigrate, and the population grew to be the densest in Europe.

The rich coal-field of Northern France extends into the eastern provinces of Belgium, where some iron and zinc are also found. A great mining industry sprang up in these provinces, and because of its abundance of coal Belgium became an important manufacturing country. Liege on the Meuse became a great engineering centre, and Lens a great mining town. The ancient manufactures for which the Flemish were famous were not neglected. Flax continued to be grown, and quantities of linen made. The woolen trade flourished at Ghent, where cotton goods were also made, and Brussels and other cities made fine lace.

Belgium is what is known as a constitutional monarchy, and is governed by a king. The legislature is composed of two houses, the Chamber of Representatives, elected for four years, and the Senate, elected for eight years. The king is commander-in-chief of the army. In 1914 Germany, who had gone to war with France, invaded Belgium so that her armies might reach the northern border of France where there are no mountains. The Belgian army opposed the Germans, but though the soldiers fought with a bravery that will forever hold the admiration of the world, their numbers were too small to hold back the waves of troops that Germany was able to send against them. Little by little they had to fall back, until at last they held only a little corner on the coast; but that the German armies could not take. Except that little corner, however, Belgium was overrun by the German soldiers. The government had to leave the capital, and as it had no town left in Belgium, the French lent it the town of Havre in which to meet.

We cannot tell the story of the war in this short space. We can only say that hundreds of thousands of the people fled from the country to take refuge in France, Holland and the British Isles. The town of Louvain with its great university, and its valuable library of ancient manuscripts, was burned, and many treasures of art and architecture throughout the country were lost to the world. Manufactures, trade and commerce, and agriculture were destroyed by the war, and with few exceptions, the people left in the country were reduced to penury.

Belgium has one rich possession in her great Congo colony, of which we may read elsewhere. Large supplies of rubber come from the Congo; the forests are rich in fine timber trees, and the hills hold stores of minerals. The climate of the Congo is hot and rainy, and it is not a healthful place for white men to live, but there is a large native population.

THE NEXT STORY OF COUNTRIES IS ON PAGE 3651.

HOW TO PRESERVE REAL FLOWERS

CONTINUED FROM 3443

WHEN we look at all the gay flowers in the garden during the summer, we feel sorry that they will last only such a short time. A clever German has discovered a way by means of which real flowers may be preserved in their natural colors, and these will last a good many months without fading. It is not very difficult to deal with flowers in this way, and if the directions are carefully followed one is almost certain to meet with success.

In order to preserve the flowers a large and rather shallow box should be obtained. We shall not want the lid, and even the bottom must be knocked out, so that we have a kind of frame. Across the inside of the frame, nail a piece of wire netting with the mesh about the same as that used for rabbit-hutches. This is fixed in its place instead of the bottom of the box in order to give a support to the flowers, which we shall put in presently, and yet to allow the air, which will dry the blossoms, to come freely through. We next get a board which is quite flat and large enough for the frame to stand on, leaving a little space all round. The only thing that is now required is a quantity of silver sand, and this can be bought at any store.

When we get the sand it will have a lot of dirt mixed with it however clean it may look, and this must be removed. The best way to get rid of the dirt is to put some of the sand into a large pie-dish, and then pour some water on to it. A great deal of the dirt will float upon the surface of the water, and if the liquid is poured away many of the bits will go also. But we shall have to repeat this process several times with each lot of sand until it is quite clean ; the best way to judge as to whether it is ready or not is to take a little in the palm of the hand, and see whether we can find any black pieces amongst the white mineral grains. When all the sand has been washed in this way, it should be spread out on a tray and allowed to become perfectly dry. Great care must be taken that it does not get dirty again. The time has now come when the flowers may be gathered in the garden. Some kinds are much more easily preserved than others, and it will be found that roses, asters, and chrysanthemums are especially good. In a general way white flowers are not so successful, as the petals are apt to turn rather a dirty yellow in color. Pinks and crimsons are perhaps the best colors of all, though one cannot well discover those which will answer the purpose without trying them. The flowers must be quite dry and free from rain or dew, and as perfect as possible.

We place the frame on its stand of wood with the wire netting downwards. First of all we put a thin layer of the clean sand inside, and after this place the flowers on the wire netting, spreading the petals with our fingers. It is now time to cover in the flowers with a layer of sand, and this should be put on very evenly. In the case of some flowers it is a good plan to turn the heads upwards before covering in with sand. Supposing the flower is bell-shaped, such as a tulip, the inside must be filled with the sand. When the flowers are quite covered in, if the box should be deep enough, one more lot of blooms may be arranged. As a rule, it is not a good plan to have more than two layers of flowers in each box.

The frame containing the drying flowers may now be removed, and it should be placed in a warm, dry place. Of course, the bottom part must be taken with it, or all the sand will fall out. A good position for the frame is on a shelf in a sunny greenhouse, where the drying process can go on quickly ; or, failing this, somewhere in the kitchen. After about ten days we may take a peep at our flowers by just pushing away a little of the sand ; if the blossoms feel crisp and dry the time has come to take them out. Supposing, however, that they are still moist, they must be left in the sand a little longer. When the specimens are quite finished they may be taken out from the frame, care being exercised in handling them, as at this stage the petals are very brittle. It will be found that the blooms are nicely preserved, and in such a condition that they will last without any water being put into the vase or bowl which contains them.

HOW TO MAKE SWEETS AT HOME

WE are all fond of candy, but perhaps some of us have never tried to make our own. Many kinds of candy are so simple to make, and give such little trouble, that we may like to try some of these recipes.

BURNT ALMONDS

Dissolve 1 lb. of light brown sugar in a teacupful of water, and stir this in a pan over the fire until it comes to the boil. Cease stirring for two or three minutes; then add ½ lb. of blanched almonds, and stir quickly until the sugar browns and coats them. Turn them on to a wire sieve to cool, dividing any that may have become joined together.

PEPPERMINT CREAMS

Mix in a basin 3 ozs. of arrowroot with three gills of cold water until smooth. Put this into a lined saucepan with 1 lb. of white sifted sugar, and keep stirring it. Let it boil for ten minutes; then move the saucepan off the fire, but stir the contents till cool. Flavor with a few drops of peppermint essence. Take up lumps of the mixture, roll them into little balls, and put them on a slab of marble that has been buttered slightly to prevent sticking. When cold, roll the creams in icing sugar. These candies are also made by flavoring fondant mixture with peppermint.

CREAM FONDANTS

Put into a pan on the fire 2 lb. of granulated sugar, and pour on to it a small teacupful of hot water. Allow this to boil about eight minutes, or till it thickens, but on no account stir it. To test it, take up a little on a new wooden skewer. If a thread forms on taking a drop between the thumb and first finger and separating them, pour the mixture into a bowl and, while warm, beat it with a wooden spoon till creamy. As it cools flavor it with vanilla. raspberry, or some other essence, and color half of it pink with cochineal. The candy is then ready.

CHOCOLATE CREAMS

Take some of the fondant mixture and roll it into balls with the hands. Place the balls on a sheet of oiled paper and leave it for twenty-four hours. Cut up about a quarter of a pound of some unsweetened chocolate and soften it in a pan standing in another one of boiling water. Add to the chocolate two tablespoonfuls of water and 2 ozs. of icing sugar, and stir it smooth. A tiny lump of butter and a few drops of cream improve the chocolate. Drop the fondant balls into it, get them out with the aid of a fork, and lay them on paper to cool and dry.

COCOA-NUT BALLS

Put into a pan and boil, unstirred, ½ lb. of white sugar and three-quarters of a small teacupful of water until a few drops crackle when dropped into cold water from the end of a wooden skewer. Now stir in 1 oz. of desiccated cocoa-nut. Take lumps of the mixture and roll them into little balls.

BARLEY SUGAR

Put into a pan and boil 1 lb. of loaf sugar, a small teacupful and a half of water, and a tiny pinch of cream of tartar. Test it by dipping in a wooden skewer and plunging this in cold water. If the sugar is brittle, it is ready for the addition of the juice of a quarter of a lemon and a little saffron coloring. Let it boil to 300° F. by the thermometer, pour it on to a sweet-oiled marble slab, and cut it into strips with scissors. Twist these and store them in glass bottles.

VANILLA CARAMELS

Boil over the fire in an aluminium or tin-lined saucepan, stirring frequently, 1 lb. of loaf sugar, three dessert-spoonfuls of glucose, and a small teacupful of water. Test it by dropping a little into cold water. If it hardens, add one gill of cream and ½ oz. of butter. Boil again, stirring frequently, till a little turns brittle on being dropped into cold water; then flavor with vanilla essence and pour the caramel on to a tin or oiled marble slab. Cut it into convenient squares and wrap them neatly in oiled paper.

NOUGAT

Blanch and chop coarse ½ lb. of almonds and dry them in the oven. Put ¾ lb. of castor sugar with one dessert-spoonful of lemon-juice into a pan, and stir it with a wooden spoon till it colors slightly. Drop in the almonds. Pour the nougat on to a marble slab, press it into cubes or mark it in squares with a knife dipped in hot water, and break them up when cold.

TURKISH DELIGHT

Melt 1 oz. of gelatine in a teacupful of cold water, and put this into a saucepan with 1 lb. of fine sugar and the juice of an orange and a lemon. Boil it up three times and then simmer it about twenty minutes till sticky. Butter a soup-plate and pour half the mixture into it. Color the remainder with a few drops of cochineal, pour it on to the rest, and set it to stiffen. Then warm the plate slightly to loosen it, turn it on to paper dusted with icing sugar, cut it into squares, and sugar these also. Store it in a tin.

MARZIPAN POTATOES

Prepare some marzipan as described in making Easter eggs, on page 3324, or mix half a pound each of castor sugar and ground almonds with the white of one egg, beaten stiff and flavored with essence of almonds. Shape pieces into the form of new potatoes, punching dents for the " eyes " with a skewer. Roll the potatoes in cocoa essence in order to coat them brown.

MARZIPAN FRUITS AND NUTS

Strawberries, cherries, mushrooms, dates, and walnuts can be made with marzipan. The hulls of the strawberries are cut out of green crinkled paper, the stalks of the cherries of twists of paper or green-covered wire. The marzipan is shaped and rolled in sugar colored with cochineal and placed on paper to harden.

Real fruit may be halved and marzipan placed between the halves.

A mushroom is shaped by flattening a lump of marzipan in the hand and hollowing a centre

for the stalk. Dust the under side with cocoa essence. Roll some marzipan for the stalk, and dip one end in white of egg to make it stick in the hole. If the white part looks too yellow, moisten the surface with white of egg and dust it with sifted sugar.

A flattened lump of marzipan can be inserted between the two halves of a dried walnut or replace the stone of a date.

Acorns in cups and numbers of delicious bonbons can be devised out of marzipan.

MARSH MALLOWS

Dissolve 2 ozs. of gum arabic in one gill of cold water. Warm and strain it into a pan over a fire, with 4 ozs. of icing sugar, stirring constantly till a little forms a ball when dropped into cold water. Remove the pan, add one and a half whites of eggs previously beaten stiff. Flavor with caramel essence. Stir and turn mixture on to a tin sprinkled with icing sugar to set for twelve hours. Cut into cubes and dust these with icing sugar.

THE GAME OF STICKERCHIEF

A SPLENDID game that can be played by any number of children is "Stickerchief." It is quite as exciting as hockey or lawn-tennis, and it has the advantage of not requiring expensive balls, racquets, or sticks.

Stickerchief is played with a handkerchief and some short pieces of bamboo, of the sort used by gardeners to hold up tall flowers. A dozen of these bamboos can be bought at any florist's for a small sum.

The game can be played on a lawn of any size, and the grass will not be injured, as it is not necessary to make any white lines on it. We have only to make two goals, one at each end of the lawn, and these will merely be formed by the flower-sticks stuck into the grass about four feet apart. When we have placed two sticks at each end of the lawn in this way we can begin.

It is best to make the first attempt with only two players. Each must have one of the light bamboo sticks, and they must stand in the centre of the lawn between the two goals. Now they must place a handkerchief on the ground, and stand on opposite sides of it with the ends of the sticks just touching the ground, about a foot away from the handkerchief, as we see in the picture.

Then one player must count "One—two—three—go!" and at the word "Go" both must try to pick up the handkerchief on the sticks. This is much more difficult than it looks. Each player tries to knock his opponent's stick away.

Presently one manages to pick up the handkerchief, and then runs as fast as he can towards the opponent's goal. Of course, the other player follows, and tries to get the handkerchief off the stick. If he manages to get it on to his own stick he rushes with it to the other goal.

In a few minutes both players become tremendously excited, for often they get within a few feet of the goal before they drop the handkerchief. Then they have a fine struggle for it. Sometimes the handkerchief flies off the stick while the player is running with it, and then the other player can often catch it before it reaches the ground. Sometimes it is skilfully knocked off, and sometimes neatly lifted off. Any way is considered fair; the game is simply to get the handkerchief through the opponent's goal and to prevent him from scoring. A game is finished when a goal is scored. A match consists of five games, and the player who wins the larger number of games is the victor.

After a little practice any number of children can play together. Two captains are chosen, and these captains pick the players who are to form the teams. Four, six, or even ten players may be in each team; in fact, the only limit is the size of the lawn.

When all are ready, and have been provided with the sticks, the captains tell the players where they are to stand—some close to the goal, and others near the middle of the lawn. Then the captains take their places by the handkerchief, and start the game at the word "Go." Of course, it becomes ever so much more exciting when a number are playing, and often it is quite a long time before either side can score a goal.

The game of stickerchief as played by a boy and girl.

If there are many players on each side they ought to be distinguished in some way, so that they can be recognized at once as friends or foes. It is a good plan to tie little bows of ribbon in the middle of each stick. One side can have green bows and the other red. These look pretty, and are far more easily seen than colors worn on the sleeve.

The game is a splendid one for a children's party, as boys and girls can play together. It has all the fascination and excitement of hockey, without the danger of bruises that are too often caused by hard balls and heavy sticks. The light bamboos used for "Stickerchief" cannot hurt anybody.

A LITTLE VEGETABLE GARDEN

WHAT TO DO IN THE MIDDLE OF JUNE

THERE is time now to look round and enjoy the sight of the rapid growth of all that we have planted. Yet we may not be idle. The tomatoes that we planted in the warmest corner we could find will need careful watering, and it is not enough to pinch out the side shoots once or twice: we must go on pinching them out as they appear.

The stems of the potatoes have grown considerably since we made our first earthing-up of the soil around them, so we may now earth-up higher than was possible at first.

If the soil be very dry where the peas are growing we must water them frequently, or put a top dressing of stable manure over the surface of the soil round about them. A top dressing of littery manure both in the flower garden and in the vegetable garden is often used. It is best applied after rain while the soil is moist; in this state the top dressing will prove a valuable means of keeping the moisture in the soil and preventing evaporation when the sun is hot upon it. Another means is to use the hoe frequently, and we have already learned how this was effectual—the moisture is lost more quickly when the tiny atoms of soil lie close together than when they are loose.

We must remember that it is not well to pull our rhubarb too closely; for each stem pulled the plant loses a great leaf, and if too many be pulled the loss is felt unduly. Now that gooseberries are in season for cooking, we should give our rhubarb a little rest, or, at any rate, pull sparingly for a time; later on, in a month or less, according to the weather, we may begin to pull again, for a juicy second crop of young stems will have grown up. Many people prefer to wait for this second crop before making rhubarb jam.

As the lettuces, or, in fact, any crops, become ready for use, make no long tarrying before beginning to use them. To wait till the whole crop becomes ready to be eaten is a fatal mistake. Rather begin to pull too soon than too late. It is a well-known fact that the more peas we pick the more we shall be able to pick, for if we relieve the plants of the many pods they bear as soon as these pods are ready for use, the plant has sufficient strength immediately to produce fresh pods. With other crops—lettuces, for instance—if we do not begin to use them as soon as we should, some of the plants will run away to seed before we can eat them.

The first crop of Lima beans should be planted by this time with another sowing later.

If we have some raspberry-canes, it is a good thing to put a top dressing over the soil in which they are growing. This dressing may consist of littery stable manure, but if this is not to be obtained, use a sprinkling of the mown grass, or some half-decayed leaf mould; the main thing is to give the canes all the moisture that is in the soil, and therefore, by this top dressing, to prevent evaporation.

In the flower garden we have now all our summer plants in their places, and if everything is not as neat and trim as it can possibly be made, no time should be lost in putting it in order. Perhaps we have plants that we have been growing in pots—our fuchsias and geraniums and others. These may well be planted out for the summer. The geraniums should have the sunniest place we can find, and it is better not to water them very frequently if we want plenty of blossom. Abundance of moisture will give us large plants with large leaves, but very few flowers. The geranium has a great deal of moisture in itself; the green stems are soft and juicy, and such plants are better kept rather dry. They go to England from South Africa, and are able to bear very hot sunshine and dry weather.

If we have a greenhouse, we have probably that beautiful rose, Maréchal Niel, in it. It flowers under glass earlier than roses grown out of doors, and needs pruning at a different time—when it has finished flowering.

If we have the care of a greenhouse as well as of a little garden, we are bound to think of how we are to stock it. Now is the time to sow cineraria seed. The best way is to sow the seed in pots or pans, which should be kept covered with a piece of glass until the seedlings appear. We must stake our dahlias and other plants as soon as they need it. The stakes must be planted firmly in the soil.

Any ferns or other hardy plants, or rose-trees that have been planted during the spring, will need more care and more frequent watering than plants that have been established all through the winter and have become hardened.

DRAWING A CAT WITH THE AID OF TWO COINS

THE four little pictures shown here prove to us how very simple a thing it is to make amusing drawings. We need a ten-cent place our five cents to the right, overlapping slightly, and run our pencil round its edge, being careful not to cut into the first circle.

and a five-cent piece, a pencil and a piece of paper. We first put our ten-cent piece on the paper and draw a circle round it; then we The ears, eyes, nose, mouth, tail, and two curves for hip and elbow, are then inserted, and a few more strokes complete our pussy.

HOW TO MAKE OLD CLOTHES NEW

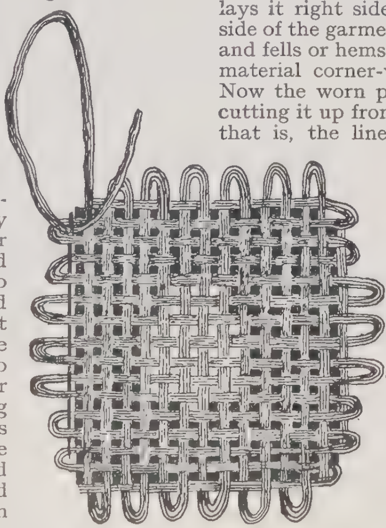
A LESSON IN DARNING, PATCHING, AND MENDING

EVERY girl should know how to repair the inevitable damage done to her clothes by constant wear and tear, and there can be no comparison between a hasty, bungled mend and a neat patch or a smooth, even darn. Let us first consider darning, work which incompetent needlewomen often dislike very much. We are going to see how, with a little patience, we may obtain quite beautiful results.

Darning

The darning thread should be fairly soft, not too coarse for the material, and as like it in color and texture as possible. When about to darn a stocking we thread the long-eyed darning needle by holding it in the right hand, point downwards, loop the end of the woollen mending over it, draw the needle out of the stretched loop so formed, and with the finger and thumb of the left hand press the looped mending through the eye. No knot is wanted.

We start darning on the wrong side at the left bottom corner of the hole—not close up to it but outside the part wearing thin, for, if the darn is not begun beyond it, this worn part will give, through the increased strain, directly the stocking is put on. The stitch is really a weaving of the mending thread with the worn and broken threads of the stocking, the needle taking up as many stitches as it can conveniently hold, picking up a thread, then leaving one, first in a row away from us, then in a row towards us. We must then take care, before drawing the thread up loosely with the right hand, after taking the needleful, to hold down with the left thumb the loop forming at the end of the thread, and leave it there to allow for shrinkage in washing. We should also be careful not to pucker the material when pulling the thread. The stitches are repeated in the same direction, backwards and forwards, and the thread crossed over the hole when we arrive at it. It is better not to let the row of loops at the ends be in line, but in steps up to the longest stitches made across the hole, then down again beyond it. This prevents too great a strain on the two threads at the ends of the darn; but, of course, the shape of the darn must depend on that of the hole.



1. A darn.

Having finished this warp darning, we cut the mending thread, turn the stocking round to the left and cross the previous threads as shown in picture 1, in a kind of lattice-work, taking care not to pierce the darning already done, but passing the needle over and under the strands alternately. The crossing is done in a regular oblong. Careful darners always put a hard wooden ball in the foot of the stocking and mend on that.

Patching

When a garment becomes worn and ragged in one part, and the possibility of darning it is hopeless, we have to patch it. For the patch we want a piece of material to match the garment. This is a matter of importance, for it would not do to use a thinner, more flimsy piece of material, and equally it would not do to apply a thicker, more coarsely woven one. If the color of the garment has faded, and we have a piece of unused cloth in which the color is still bright, we can usually make the color fade by exposing it to the sun or washing it in water with a little soda dissolved in it.

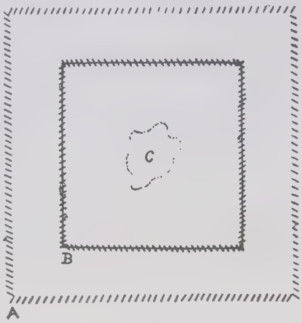
We will suppose a little girl has worn a hole in an under garment, and she is going to sew on a patch. She lays the piece of calico over the garment with the hole in the centre, and cuts out of it a square or a four-sided piece, according to the shape of the hole. The piece must be a good deal larger than the hole. Next she lays the garment on the table right side downwards, folds over the edge of the patch on to its right side and lays it right side downwards on to the wrong side of the garment. Then she tacks the patch, and fells or hems it on, folds the patch with the material corner-wise, and turns the garment. Now the worn part has to be taken away by cutting it up from the hole along the diagonals, that is, the lines made when she folded the material from corner to corner, as if she wanted to make a triangle, until a point is reached clear of the worn part, and enough material is left to turn under and sew on to the patch, as shown at B in picture 2; A, of course, shows the outer edge of the patch, and C is the original hole. In sewing round this inside square, care must be given to the corners. She snips these up a little way and turns the edge under with her needle. The patch should lie flat; it will do so if the width between the fell and the sewing is three-eighths of an inch wide.

A flannel patch is herringboned on to a garment as shown on page 939, for the patch would not lie flat if it were filled and sewn on exactly like a calico patch. For a patch at the elbow or near a seam, rip up the seam, and make a new one for one side of the patch. Be careful to see that the patch and the material have their threads running in the same direction.

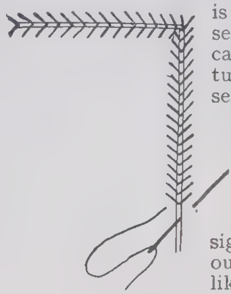
Repairing a Slit

Slits will sometimes spoil the nicest frocks. A straight, clean-edged slit is easy to repair, for we can place the two edges together and darn or fine draw it—that is, draw it together

with fine warp darning stitches; but a three-cornered or jagged slit is more difficult to treat. The method depends on the nature of the tear; sometimes a patch may be necessary. If the material be striped, the edges can be placed together and run on the wrong side. In doing this we slope the running to a point at both ends. Such a little seam is only possible when the stripes are narrow and close together. In the case of a three-cornered tear, we may darn the edges together, using either No. 60 cotton or fine silk, according to the material. No loops are left at the ends as in stocking darning, and the darn is fine drawn with very fine stitches placed close together, so that they are hardly visible to the eye.



2. Patching.


3. Fish-bone stitch.

A three-cornered tear is often successfully treated by hemming a patch on the back of the material with very fine stitches, and tucking in the frayed edge of the tear with the needle just enough to allow the edge to be hemmed down with fine stitches on the right side. The hems must be quite close together, or the patch will show through. A clean tear in a woollen garment may be mended in fish-bone stitch, as shown in the illustration on this page.

GLOVE MENDING

How long gloves would last if those dreadful holes did not come as it were by magic!

A common fault in glove mending is the use of too coarse a cotton or silk. We should choose quite a fine kind and use a small needle. Then, when the seam of a kid glove splits, it is easy to make the same little stitches as the glove-maker did before. In mending holes in cotton or silk materials, it is best to put the finger of the glove with the hole in it upon the first finger of the left hand, and fine draw the hole. As the hole is usually close to the seam at the tip, we can use the material turned under at the seam, to make a foundation for the tiny darn. We must fasten off the thread on the wrong side, or we shall get that unsightly thread popping out of the finger-ends like a jack-in-the-box. A tear is more troublesome to repair, and this usually comes in a new pair of kid gloves, the skin of which has become rotten, or has a thin, weak spot. If the glove be longer than is really necessary, it is a good idea to cut off a little strip at the sleeve-end, shape a piece to fit in the tear exactly, and stitch in the patch in the same way as the seams are sewn.

The fewer punctures of the kid with the needle the better. Drawing the two edges close together usually makes matters worse, for the kid is likely to tear in a fresh place.

OUTDOOR GAMES FOR BOYS AND GIRLS

BUTTERCUPS AND BEES

THIS is a new game, but may prove good fun. There should be an even number of players, say, twelve—six girls and six boys: that is, six buttercups and six bees. The buttercups sit or stand on the lawn in a row, each holding a cup made of a piece of paper, twisted into the shape of a fool's cap. A number is pencilled on the inside of each —1, 2, 3, 4, 5, 6—according to how many buttercups there are. The bees then stand a short distance away, each with a little ball of crumpled paper. These are numbered as the cups are; but before beginning the game, the boys should exchange balls with one another, so that the buttercups cannot possibly tell the number of any boy's "bee." For the same reason the girls should exchange cups. This being done, and the lines formed again, the paper balls, or bees, are tossed all at once into the air towards the buttercups; the higher the better, and the buttercups do their best to catch them. Any player whose cup-number is the same as that on the bee it has caught changes places with the boy who threw it, and the last couple to do this ends the game. The winners are the couple who have become buttercups or bees in turn the greatest number of times during the game. As some may find it difficult now and then to catch the bee in the cup, it is quite allowable to pick it up from the grass where it has fallen, and drop it in. The exchanges of the cups and the balls should take place every time the bees are returned, as there would be very little fun to any of the players if their side knew the numbers of the others.

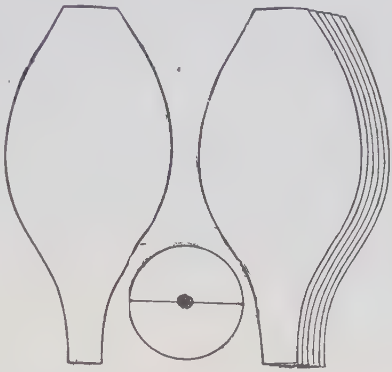
BATTLEDORE AND SHUTTLECOCK

THIS game is about six hundred years old, and is still popular. The battledore is made of stretched parchment like a little drum, with a long, light handle. The shuttlecock should not have too many feathers, or it will not fly quickly enough. At first it may seem difficult to keep it in the air with the battledore, but with a little practice this will soon become easy. Although one player can play alone, it is much better when two players play together, striking alternately at the shuttlecock and keeping it in the air as long as possible. The player who misses loses, and the other player counts a point. If there are several players, they stand in a ring, and pass the shuttlecock from one to the other, the first who fails to strike it being out. The last player left is, of course, the winner.

MAKING A HOT-AIR BALLOON

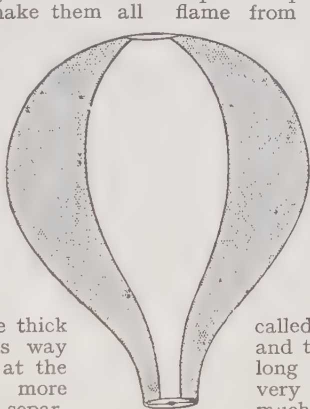
ALMOST everyone has seen the big paper balloons that are sent up at firework displays. Generally they are made to carry colored lights, so that when the balloons fly away they can be seen until they rise to such a height that they look like tiny stars in the sky. These balloons are made of tissue-paper, and they are not filled with gas, but with hot air. It is quite easy to make one.

At any stationer's shop we can buy large sheets of tissue-paper. It is best to buy a quire, which will cost about ten cents; and, if possible, we should get two colors. Then we can make our balloon with colored stripes. When we have got the paper, we must lay it all out flat on a table. Then, with a soft pencil, we can draw on the top sheet the shape shown in picture 1, but as large as possible on the paper that we have. When we have marked the shape, we can fold the first sheet down the centre from top to bottom. This will show us if the two sides of the shape we have drawn are the same. If they are, we can cut round the pencil-lines with a pair of scissors. This first sheet will now form a pattern for all the others. We should lay it over them and cut very carefully through the remaining twenty-three sheets with the scissors, so as to make them all exactly the same size as the first one. We now have to stick them all together very firmly.



1. Pattern cut out. 2. Wire ring and wool. 3. Pile of sheets for gumming.

We first take a white piece and lay it flat. Then place over it a red or blue piece, so that on one side a little of the white shows. Put another white and another colored one over them in the same way, always leaving a little of the edge of each sheet showing. Picture 3 shows clearly how this must be done. We next brush some thick gum over the edges. In this way we can gum five or six pieces at the same time, and do it much more neatly than if we did each piece separately.



4. The completed balloon.

When the gum has been spread smoothly, we pick up the top sheet and carefully stick the edge to the ungummed side of the sheet below. The same thing is done with six sheets, using white and colored pieces alternately, and then joining the first and the last sheets. We shall now have a paper balloon, complete except for a small hole in the top. To cover this we cut a circular piece from some of the paper we have left over, and then stick it carefully and very neatly over the hole. When the gum has dried, we must put the nose of a pair of bellows into the opening at the bottom and blow air in gently. In a few minutes our balloon will expand, and we can see if all the edges have stuck properly. If they have not, we must put on a little more gum, because, of course, the balloon must be air-tight.

We must now measure the opening at the bottom, and with a piece of thick wire make a ring that will just fit into it. We fix one piece of wire across the centre of the ring, as shown in picture 2, and in the middle of this straight piece put a little tuft of cotton-wool. Now we very gently fix the ring into the opening, fold the edge of the paper over it, and gum the folded part down firmly. Our balloon is now quite finished, as we see it in picture 4. Taking it out into the garden, we choose a place sheltered from the wind, and then pour a little alcohol or oil on the cotton-wool, being very careful not to let any of the spirit get on to the paper. When it is all ready, we should get somebody to hold the balloon up for us while we put a match to the cotton-wool. We must do this very, very carefully, because everything depends upon this moment. If the little flame from the spirit touches the tissue-paper, it will, of course, burn a hole in it. In a few minutes the hot air will make the balloon expand till it is nicely rounded out. Holding it until it looks quite full, we then gently let it go. It will rise very quickly into the air, and will go to a tremendous height. We shall have plenty of paper left, and can make another at once. If we send the next one up at night, we can tie a small firework to it—those called Bengal lights are the best—and then we shall be able to see it as long as the light burns. If we are very ambitious, we can make a very much larger balloon by sticking sheets of paper together before we begin to cut out the shaped pieces. The whole secret of sending up the balloons is to choose a starting-place sheltered from the wind. Of course, on a very windy day it is no use trying at all. A moderate breeze does not matter, because if the balloon is sheltered until it has risen a little way it is safe.

There is no danger, because the balloons are taken into the garden before the spirit is used. Even if the tissue-paper catches fire through our want of care, it can be crumpled up and put out in two seconds.

DELICIOUS COCOA-NUT CANDY

COCOA-NUT candy can be made with or without milk, but it is certainly nicer and smoother when made with it. To make a really nice sweetmeat we shall want ingredients in the following proportions: half a pound of desiccated cocoa-nut—the word desiccated only means dried, but it is the proper thing to ask for when buying it at the grocer's—one pound of loaf sugar, a small teacupful of milk, and half a teaspoonful of carbonate of soda.

First we put the sugar into a large enameled saucepan and pour the milk on to it. Then we put the saucepan on the stove, and let the contents come to the boil, stirring all the time to prevent burning. We can tell when it boils by the fussy bubbling it makes. The milk is allowed to go on boiling for five minutes, while we are still very careful to stir rapidly. Then the carbonate of soda is stirred in. The contents of the saucepan must not be allowed to boil over. Next we take the saucepan off the fire, and stir the cocoa-nut into it. A shallow tin is lined with a piece of white paper, and half the contents of the saucepan are poured into it. A few drops of cochineal are then stirred into the remainder in the saucepan, to make it pink, and this is poured on to the cocoa-nut candy in the tin.

We must next press the surface of the cocoa-nut candy even with a knife, and set it aside to cool. When it is cold, we take a sharp, broad-bladed knife and cut it into bars as it lies in the tin.

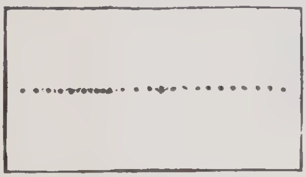
Some people make cocoa-nut candy without the carbonate of soda; but the addition of a little certainly gives lightness to it, makes it more digestible and nicer to the taste. Such a candy is perfectly wholesome, and is not at all likely to make us ill after eating it.

HOW TO PASS THROUGH A POSTCARD

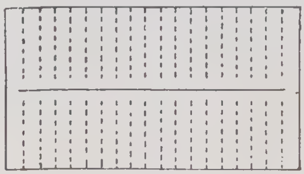
IT seems almost impossible to pass one's whole body through a plain postcard, and yet it is fairly simple to do so.

We must take an ordinary postcard, or, if we have not got one handy, any piece of card or paper the same size will do as well, and cut a slit across the middle to within a quarter of an inch of each side, as shown in picture 1.

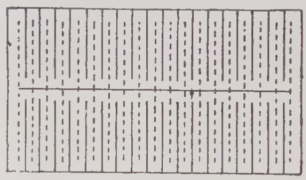
We must then very carefully make straight cuts, about a quarter of an inch apart, from the top and bottom edges of the card to within a quarter of an inch of the slit that we have already made down the middle, as in picture 2. We next make straight cuts from the original slit in the middle of the card to within a quarter of an inch of the top and bottom, taking care that these come exactly in the centre of the spaces between the cuts made from the outside edges. The final result of the cutting is illustrated in picture 3. If we now pull each end of the card we shall find that we have in our hands a long, endless, zigzag ribbon. We should fold the corners of the zigzag ribbon back carefully, and when this is done we have a huge paper hoop through which our body can easily pass.



1. Where to make the first slit.



2. The second series of cuts.



3. The complete series of cuts.

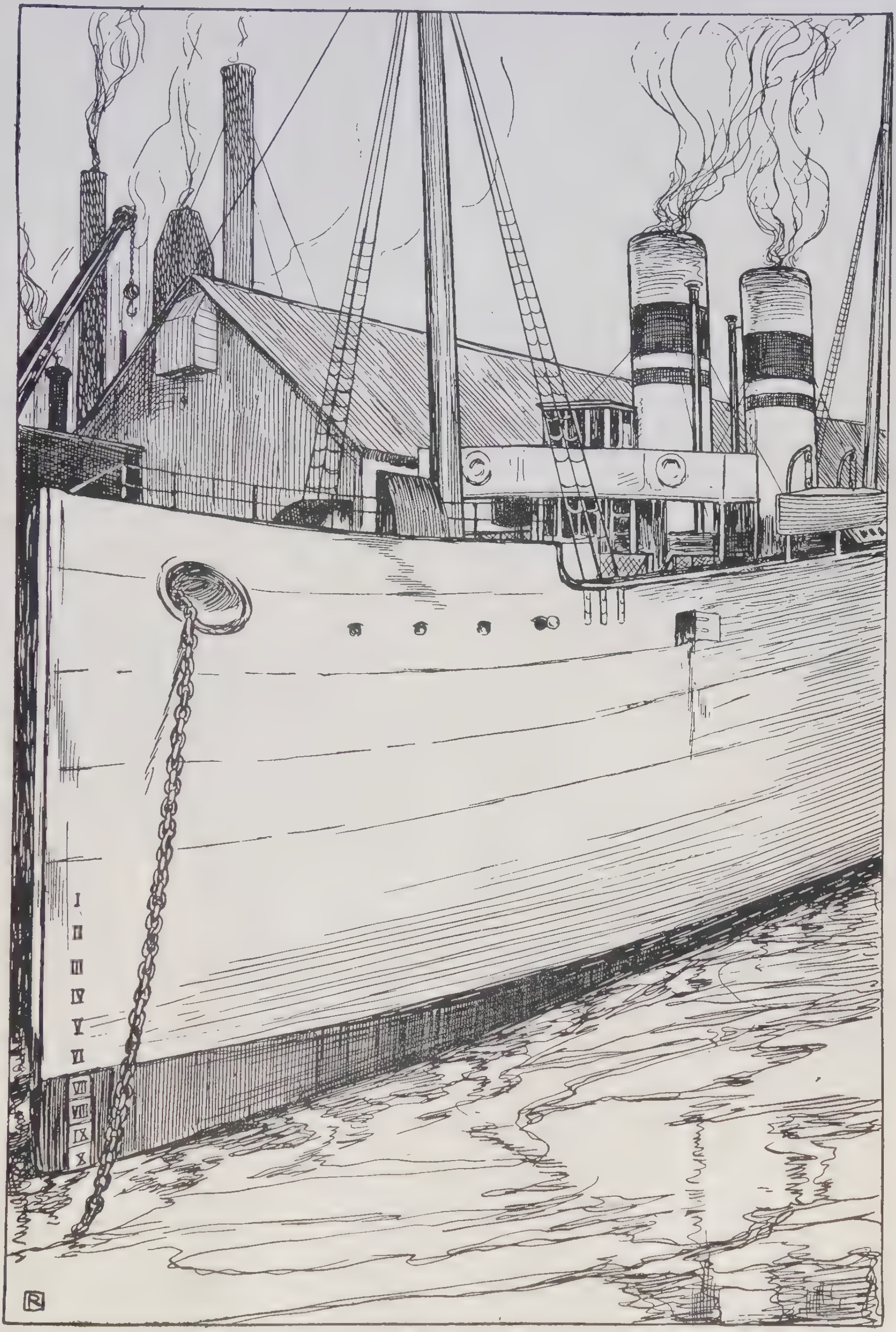
ANSWERS TO THE PICTURE PUZZLES ON PAGE 3443

ON page 3443 are twelve little pictures, in each of which the artist has made a mistake. The following solutions are the correct ones:

1. The shells are those of a walnut, but the kernel that has apparently come out of them is that of a Brazil nut.
2. The little girl is gazing out of the window at the crescent of the moon, which is in a position in which it never appears to us.
3. The buttons on the man's coat are on the left side, whereas they ought to be on the right side of the opening in front.
4. This chicken has a duckling's beak.
5. A lion cannot climb a tree, though many other members of the cat tribe can do so.
6. Hens and chickens never enter a brook, pond, or river for the purpose of taking a swim.
7. Tigers do not eat grass or hay, but live entirely upon flesh. They are carnivorous.
8. The rabbit in the picture has a tail similar to that of a squirrel.
9. This curious animal is an echidna, commonly called an Australian ant-eater. In this drawing it has the hind legs of the ornithorhynchus. The hind legs of the echidna are shaped backwards and outwards, and are not webbed.
10. The antelope shown is found in hot countries, and could not live in the Arctic regions.
11. The boy is mounting his pony from the wrong side. The correct side from which to mount is the left or near side.
12. The boy is writing with his right hand and the mirror reflects him also writing with his right hand, whereas a mirror should always reverse everything as it reflects it.

THE NEXT THINGS TO MAKE AND THINGS TO DO ARE ON PAGE 3639.

WHAT IS WRONG WITH THIS STEAMER?



When we stand on a busy wharf at a large seaside town, we often gaze at the great ships that bring us the wheat and the timber and all the wealth of the world for use in all parts of the country. Here is a picture of one of these great steamers, and in making his drawing the artist has made at least ten mistakes. Can we find out where he is wrong? We can compare our list with that given on page 3644 of this book.

A MAGNIFICENT WALNUT TREE

This great tree, which is ninety-six feet high and looks as if it might be a remnant of the primeval forest, was only twenty-two years old when this picture was made, and was grown by Luther Burbank from the cross of a black walnut which grows in the East and another black walnut which is a native of California. In the year 1878 Mr. Burbank began to make experiments with walnuts, in the way described on page 3563. Some of his experiments were failures; but from seven years of patient, painstaking labor, he produced two valuable walnut trees. One of them he named the Paradox, and the other, which this picture shows us, he called the Royal Walnut Tree. In the corner you see a picture of Mr. Burbank in his younger days.

WHAT THIS STORY TELLS US

IN the following pages we are told of the wonderful work of Mr. Luther Burbank of California. This man seems to be able to change plants of all sorts as he pleases. Yet the means he employs are very simple. The first plan is by selecting the individual plant which shows a quality he wishes to increase. Then the seed of this plant are sown and the individual plants showing an increase of the quality are selected and the seed from them are planted, and the process is repeated again and again until a plant very different from the original is secured. Then by crossing different varieties very many new and strange results are gained. You are told of some of the queer plants he has produced, and also what he hopes to do.

A WONDER WORKER IN PLANTS

CONTINUED FROM 3399

TO be told that we need not go on from one year's end to the next eating the same kind of fruits with the same flavors, admiring the same kind of flowers, smelling the same fragrance; that we need not make our bread, even, with the same kind of grain, sounds much like a fairy story, indeed. One can scarcely believe that shapes, colors and perfumes of flowers may be of our own choosing, and that new trees bearing a kind of fruit never before known, may be created at one's will. We are quite used to the fruits as we have them now and think of them, no doubt, as having always been as they are. Changes have been made in the plant world, however, which are very wonderful.

For example, the strawberry as it is to-day is a much improved fruit over the common wild strawberry, its ancestor. And this improvement has come through the great care that has been given to the strawberry plants for a long, long period of time. At first people were satisfied with the small, wild strawberry of the fields. If they transplanted it they took what they found and gave no thought toward making it better. Later, however, only the best plants were encouraged and these were given every chance to do their best. In this way, the art of making new strawberries came and now we have berries which vary greatly as to size, color and flavor. But this has been the work of three hundred years. It is only after much intelligent and careful experimental work that we have been shown how nature's tendencies may be guided in a direction we ourselves choose, and bring results in a very short time.

WHAT WE ARE PROMISED

Nature's way can be discovered so that any one, without much difficulty, can breed new plants, new fruits, new flowers which will be more useful and more beautiful than any we have had before. Not only can new plants be called into existence but we can make those we already have much better. Better grains are promised, better vegetables in all forms, sizes and flavors; poisonous qualities may be taken out of plants so that we may have new eatable varieties; we may have plants that can resist the effects of the sun, wind, rain and frost as we already have fruits without stones, seeds or spines!

LUTHER BURBANK AND HIS WORK

The man who has been most successful in changing and altering plants is Mr. Luther Burbank, known as the great American plant breeder. He was born in Lancaster, Massachusetts, March 7, 1849. He was a farmer's son and loved nature from the start. But to love nature was not enough. He un-

derstood nature, too, and it was this understanding, united with his sympathy for plants, that made him able to do things that no one had ever dreamed of doing before. He did market gardening and seed raising in a small way.

On one of his potato plants, he one day found a seed ball in which there were twenty-three seeds. These he carefully preserved and planted. From the seeds grew twenty-three healthy plants, from each of which grew a different kind of potato. One of the plants was especially strong, and from this was taken a large cluster of potatoes which were unusually large and smooth, and of a very fine quality. The potatoes were sold for seed which proved to be so good that the gardener who bought them called them the Burbank potato. It is said that since that time about twenty million dollars' worth of the Burbank potato have been raised in the United States.

In 1875 he left New England and moved to Santa Rosa, California, where he has since lived and carried on his work. Santa Rosa is a little Californian village lying in a fruitful valley. It seemed just the place for him to carry on the work he wished to do; for it has a wonderful climate and its soil is rich and varied. Here he lives in his cottage, covered with vines and blossoms and surrounded by his world-famous gardens. His experimental grounds are at Sebastopol, close by.

He treats his farm as a laboratory in which he makes experiments with all sorts of living plants. Some of his experiments cover a period of twenty-five years, or even longer. He is a tireless worker, and never wastes a moment of time, or lets any one else waste it for him, and a large sign reminds curious visitors that they are allowed only five minutes in the gardens.

Mr. Burbank's ways with plants are no secret. Most of the changes he makes in plant life are made either by selection or by crossing. I shall tell about the process of selection first, as that seems to be the simpler way of the two, and one that any man, woman or child might use if he only had patience and a love of the work.

WHAT SELECTION MEANS IN THE CULTIVATION OF PLANTS

You have already been told that there is a tendency in each plant to be different in some particular from any other one of its kind. No two plants are quite alike. One is stronger than the other, the flower of this one is more brilliant than any of the rest, or another is larger in every way than its fellows. Mr. Burbank is always on the watch for the qualities which he values most, and which he wishes to appear in the new plant he has in mind. So he often sows from 100 to 10,000 seeds of a given sort. When these grow up he selects ten, or it may be fifty, often only one, of the plants, and these he lets live. He brings the flower to fruit and lets the seed ripen. In turn, the seeds of the chosen flower are planted and a selection is again made from that group. Sometimes this selection and replanting is done again and again before he is satisfied with the result. Thousands of experiments are often made to get one plant, while millions of plants have been produced, kept, then cast aside that a few may be found worthy of cultivation. He sometimes has as many as three thousand experiments going on at the same time. Perhaps the story of how his crimson poppy came will show best how this plan of choosing and selecting was used to bring an entirely new poppy among our flowers.

HOW NEW POPPIES WERE CULTIVATED FROM WILD SEED

The fields of California are often golden with a wild yellow flower known as the California poppy. Mr. Burbank once noticed a little plant not quite like the others. It showed a delicate crimson streak on the inside of the flower. This was hint enough! He knew the crimson streak meant that crimson poppies had existed sometime in the past and that somehow they had been driven out. All they needed was another chance and they would come back. We shall see how Mr. Burbank gave them that chance. He guarded the little flower with the crimson streak in its yellow. He raised young poppies with the seeds from this flower. When these poppies bloomed many of them showed a touch of crimson and in some of the flowers more crimson was seen than was found in the mother plant. Another selection was made and the flowers showing the greatest amount of crimson in their petals were chosen and treated as the others. Each generation of flowers showed more crimson than the one before, until the pure crimson poppy as we now have it came back to us. The blue Shirley poppy has much the same

history. Out of 200,000 seedlings Mr. Burbank discovered one flower which showed a faint streak of blue. This blue was given its chance and the rest was a matter of selection, time and perseverance. Mr. Burbank says he did nothing marvelous. He merely gave the crimson poppy and the blue poppy a chance to come back and they came.

There seems to be no limit to the results that can be obtained by this plan of selection. New species of wheat have, already, been brought out in this way.

THE PROCESS OF CROSSING VARIETIES OF PLANTS

To make variations by crossing requires some knowledge of the structure of flowers. Yet, when one keeps in mind those parts of the flower which have to do with the production of seeds, it is all easily understood. The pistil is the organ of the flower which bears the seeds. It is usually in the centre of the flower and is surrounded by slender bodies with enlargements on the top. These slender bodies are the stamens and the enlargements are the anthers, which hold the yellow powder or pollen needed to develop the seeds in the pistil. When the pistil is full grown it is ready to receive the pollen. In a great many plants the pistils and stamens on the same flower are ready to do their work at different times. The anthers may have deposited all their pollen before the pistil is ready to receive it.

However, the wind carries pollen in all directions, and many insects, especially the bee, help to distribute it among the different flowers. But if no pollen at all reaches the pistil the seeds cannot develop and the pistil dies. Again, if the anthers were cut off before they opened to discharge the pollen and the pistil were covered to prevent any pollen grains from coming to it, the pistil would die. If all the flowers of its kind were taken away, the seeds could never be fertilized. All this is to show how necessary it is for the pollen to reach the seeds in one way or another.

HOW POLLEN MAY BE BROUGHT FROM ONE PLANT TO ANOTHER

If, however, you should *bring* the pollen from another flower and deposit it upon the top of the pistil you would soon find the pistil maturing and the seeds forming as if you had not interfered with the flower in the least. This is just what Mr. Burbank does so skilfully. He holds the flower of a growing plant in one hand and with a camel's hair brush takes the pollen from the anthers of another flower and with it covers the pistil of the flower which he holds. This gives the flower all the pollen it needs and just the kind he wishes it to have. Then he covers it with a paper bag so that no pollen carried by the wind or the bees can reach it. When the seeds have ripened they are gathered and sown and the resulting plants are somewhat like both plants concerned in producing the seeds. From this generation Mr. Burbank chooses again, pollinates again, and guards the seeds with the same care. Chosen ones are kept from each generation. This goes on and on until Mr. Burbank either gets the results for which he is working, or sees that the results which come from his efforts are not what he desires.

NEW WALNUT TREES ARE DEVELOPED

It was in this way that the Paradox walnut tree came into existence. Pollen was taken from a flower of the English walnut tree and dusted upon the pistil of a flower of the native California walnut. Great care was taken of this flower, and the nuts produced were planted and watched with interest. In thirteen or fourteen years walnut trees thirty or forty feet tall had grown up, unlike either one of the parent trees. The trees are large and handsome, but they are not good nut-bearing trees. However, in spite of their rapid growth, which is about four times as fast as that of the English walnut, the wood is excellent. It is fine and hard and of a very beautiful color, and promises to be of great use to the cabinet worker. A row of the Paradox walnut trees grows in front of Mr. Burbank's home.

Crossing in the same way the California black walnut with an Eastern variety produces the Royal walnut. This is a handsome tree, but it is of slow growth. It has, however, a great nut-bearing capacity. Perhaps some day we shall have a tree with all the desirable qualities combined: one that will be a rapid grower, a great nut bearer, and with firm, strong and beautiful wood which can be used by the cabinet maker.

Experiments with the various fruit trees seem to result in one surprise after another. He has given us about sixty new varieties of plums and prunes, many

new apples, new cherries, new quinces, and one absolutely new fruit, the plumcot, made by crossing the apricot and a Japanese plum.

PLUMS AND OTHER FRUITS ARE IMPROVED

There is the Bartlett plum with its interesting history. The story is told that as Mr. Burbank was eating a plum one day he noticed that it had a flavor similar to that of the Bartlett pear. He saved the pit, followed his usual plan of guarding and selecting, and the result is a plum which has the exact fragrance and flavor of the Bartlett pear.

The Climax plum is the result of a crossing of the bitter Chinese plum and a Japanese plum. We also have plums with extremely small stones and plums with no stones at all!

HOW NEW KINDS OF APPLES ARE MADE

Some apples he has given us are larger and better flavored than those usually grown. The same is true of the cherry, peach and quince. One quince that he has produced can be eaten raw, and has a flavor like the pineapple.

One would think that the length of time which a tree takes to grow would make it impossible to make so many experiments in one lifetime. This is ordinarily quite true, but Mr. Burbank overcomes the difficulty by grafting his seedling plants on old trees. Grafting is placing a cutting from one tree under the bark, or in the wood of another. It is generally done in the way we have described on page 5896. If the work is carefully done, the graft becomes part of the older tree, and its growth is much quickened.

This graft draws nourishment from the fully developed circulation of the older plant. Were it not for this, we should have to wait years to discover what sort of fruit the new plant would produce. It takes from six to seven years for a plum tree to come into bearing. Out of thousands of seedlings the fittest (perhaps ten or twenty) are taken and grafted on the branches of a full grown, strong plum tree. In the next season that seedling will bear fruit. Sometimes twenty, or even hundreds of seedlings are grafted on one strong tree. In one instance Mr. Burbank had 600 varieties of apples, green, red, sour and sweet, grafted on one apple tree. Plum trees, too, often carry as heavy a graft as this. If the fruits that result are all that is desired, the new apple or plum, or whatever fruit it may be, is kept, cuttings from it are grafted, and it soon increases in numbers.

NEW BERRIES DUE TO MR. BURBANK'S WORK

Next in extent to Mr. Burbank's work in plums and apples, is his success in producing new varieties of berries. Here again we have a score of new varieties of great market value: better blackberries, raspberries, strawberries. The Primus is a cross between the Siberian raspberry, a small fruit about the size of a half pea, brownish, seedy and tasteless, and the Western dewberry. It has the best qualities of both berries combined, and a perfect balance of characters. It is ripe before most of the other raspberries and blackberries begin to bloom. He does not recommend this plant, however, for general cultivation. The Phenomenal, which is a cross between the California dewberry, and the Cuthbert raspberry, is a berry of very large size, clear red color and looks like a raspberry.

When he succeeded in growing a cactus without thorns, it was said that Mr. Burbank had accomplished the most important task he had yet set himself. The cactus, as you know, is a fleshy-stemmed prickly plant. There are many varieties of cactus, most of them without leaves. The thick skin, with which the plants are covered, prevents the moisture which is drawn up through the roots from evaporating quickly, and in some varieties a store of cool liquid is found when the plant is cut. The fruit of some of the cacti is eatable, as, for instance, the fruit known as the prickly pear, called opuntia, which is a member of the species. It was found too that if it were not for the spines with which they were covered, some of the plants would make good fodder for cattle.

HOW THE THORNS CAME OFF THE CACTUS

To remove the thorns and improve the fruit was the work of much selection and crossing. An almost spineless opuntia cactus was used in the cross. In the first generation, the stock was prickly, in the second, less so, and in the third, the cactus slabs were without thorns!

Mr. Burbank has 500 kinds of edible cactus with fruits; yellow, crimson, and green, and with varying flavors. They

grow in great quantities and are ripe all times of the year. With the thorns gone and the fruit improved, the cactus bids fair to be an excellent food for cattle, in dry regions. It has been used already in many places as green fodder, when other vegetation fails.

FAILURES AS WELL AS SUCCESSES ARE MET

One might go on and tell of thousands of experiments that this plant transformer has made, but I have chosen here only those with results bearing directly on our life. But not all experiments have had, in one sense, valuable results. Mr. Burbank has had his failures, as well. He himself is often surprised with strange and useless outcomes. A strawberry was crossed with a raspberry. He got a plant that looked like the strawberry and which sent out underground stolons, strawberry like. Later it sent up long canes from four to five feet high, in raspberry fashion. Then it burst into bloom and bloomed more than any strawberry or raspberry bush was ever known to do. But instead of the much looked-for berries it produced only small green knobs.

Chestnut trees eighteen months old surprised him by bearing nuts two inches in diameter. Though but three feet tall, these trees were bowed down by the weight of their nuts.

NATURE IS SOMETIMES WISER THAN MEN

Sometimes he is reminded that Nature has been wiser than he thought her. When he wanted a walnut with a shell thin enough to be broken with the fingers, he knew how to get it. But the birds and the squirrels found an excellent and easily obtained meal, and it was of no use for Mr. Burbank to try to get any of the nuts for himself. So he had to have the shells on his nuts as thick as they were before. The same thing happened when he bred the prickly burs off the chestnuts. Again, only the birds and the squirrels were benefited, and the burrs were allowed to grow on again.

When the white blackberry, which he calls the Iceberry, is crossed with the red raspberry, about half the plants bear fruit like the red raspberry and the other half bear fruit like the white blackberry. But the flavor is that of both berries.

Beans of all sorts were crossed. They covered one-half acre. Some of them grew to be twenty and thirty feet high. There were all sorts and sizes of pods: some long and slender with long stems, some long with short stems; others short with long stems, while some long pods had stems so short that the pods themselves doubled up on the ground. From the red and white pole bean cross came striped pods, while the beans themselves were jet black. All the colors known in beans show themselves in the varieties that have come from this cross.

THE WONDER WORKER'S GREAT POWERS OF OBSERVATION

Mr. Burbank works no miracles. He says himself he just discovers tendencies in Nature, then chooses, encourages and guides those tendencies in the direction he wishes. And he says he can do this because the plant world is so very very old and so full of life. Nothing takes too long to try, no failure is too great to frighten him.

It is said that his powers of observation are so highly developed that he does not need to wait until a plant has flowered to see the probable result of an experiment. He can tell by the leaves and stock of a plant whether it is likely to have the qualities for which he is seeking. Men who have known him say that out of thousands of seedling plants he can pick the small number—perhaps not more than a hundred—that are worthy to be preserved for his purpose. These are planted out and carefully cultivated, the rest are gathered into heaps and ruthlessly destroyed by fire. Artists say that he can easily see in the colors, tiny differences that to your eyes and mine do not exist and that he can detect the faintest differences in the exquisite odors that float above a bed of flowers. He lives very simply and quietly among the plants and flowers in which he takes such keen delight, and in his old age still occupies himself in seeking to develop new seeds and fruits.

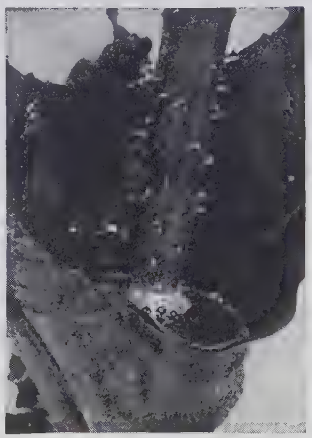
"My dream," he says, "is that I may be able to point out to mankind the way to change the whole world of plants to suit its needs and pleasures."

His life is an inspiration to those among us who may be easily discouraged if our efforts meet with failure. It tells us not to be disheartened, if we do not at first succeed, but to pluck up our spirits, and, as the old school song says, "Try, try, try again."

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 3607.

PLANTS THAT CATCH AND EAT INSECTS

The teasel, that grows in the corners of fields and other waste places, has its leaves joined together at the base, forming a cup that collects the rain-water and drowns insects.



Here we have a closer view of the teasel's drowning-pot for insects. To what extent the teasel benefits by the insect soup that is formed after a shower, is not known.

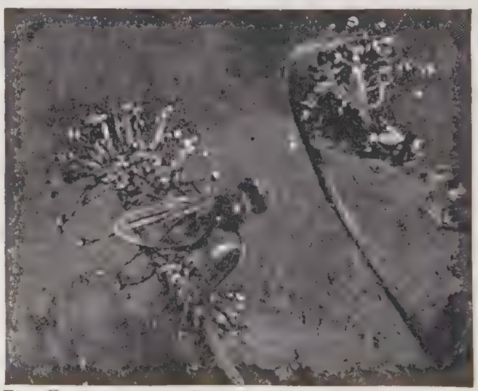
The sarracenia's leaves are like pitchers. They collect rain-water and feed upon insects that are drowned. The right-hand leaf here has been opened to show the insects.

This is a nepenthes. Its pitchers hang on long stalks, and insects are attracted by their honey-glands and bright colors. Once inside, they slip down and are drowned.

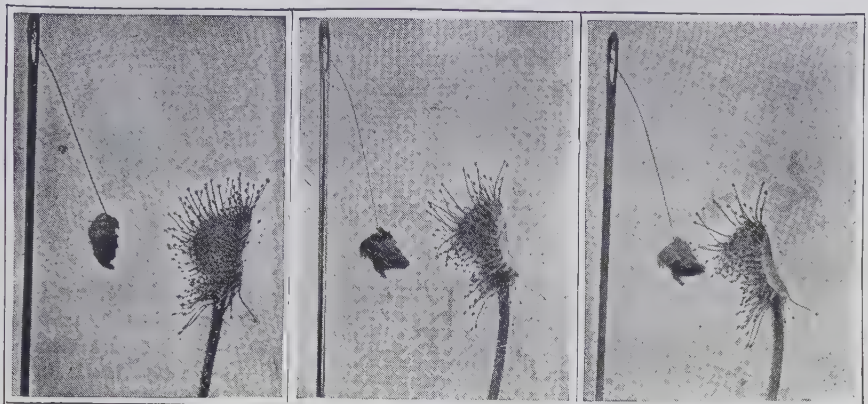
Here we see a single pitcher of the nepenthes with some insects about to enter. The pitcher has an ingenious lid on top, that opens only when the plant is fully grown.

Here we see the same pitcher cut open to show the dead insects inside. The plant digests them, for the pitcher produces digestive acids, just like an animal's stomach.

The Venus's fly-trap, shown here, was called "Nature's miracle" by Linnæus, the father of modern botany. If an insect alights upon a leaf, the leaf closes upon it like a spring trap in a few seconds, and digests the insect, taking, perhaps, a fortnight over the meal.



The English plant, the sundew, feeds upon insects. When a fly settles, it is held by a sticky juice that the plant produces, and the hairs close round the insect and digest it. On the left we see a fly that has just settled, and on the right the fly half digested.



The sundew, a carnivorous plant, seems to know when food is near, for if meat be placed close to it, the plant reaches out for it, as shown in these photographs taken at intervals of forty minutes.

DOES A PLANT EAT?

CONTINUED FROM 3514

IN the answer to another question, on page 2799, we have seen that certain leaves of plants can tell the difference between light and dark, and this is a sort of seeing, though it is very different from our sight, and not nearly so useful. In this question we may remember, first, that trees are a kind of plant; and, second, that *feeling* means any kind of sensation, including the sensation due to light. So that really the answer is "Yes."

And, even if by *feel* we mean only the sensation of *touch*, the answer is "Yes" as regards many plants, that we call *sensitive plants*. Some of these are specially clever at feeling things, because they actually eat insects, and they require to know when an insect touches them. Plants of this kind are readily found growing wild in the United States, in Canada, and in many other places. The leaf of the plant is covered with tiny sticky sensitive things looking like short hairs. If we touch the leaf with a finger, we see that it curls up. If a very small insect touches it, it is caught by the sticky stuff on the hairs, and the leaf quickly rolls up and catches it. So the insect dies, and the plant digests its dead body, and eats it. This is the simplest kind of what are called *carnivorous* or flesh-eating plants that are found in all parts of the world. Some of them make large traps, that close up and catch even strong insects. We know, then, that plants can see and can feel; but there is no proof that they can hear. Charles Darwin had the trombone played to a plant, and many other people have made experiments of a similar kind, but they all seem to show that plants do not hear.

HOW FAR CAN WE SEE?

When we say that our eyes see, all we really mean is, that light has entered them, and has affected them. If that happens, we see. It does not matter whether the light has been produced by a match that someone has held just in front of our eyes or whether the light has come from a star so distant that its light took ten thousand years to reach us. In either case, if light enters our eyes in sufficient quantity to affect them, we see. This is quite simple when we come to think of it, but most people are confused about this question because they do not ask it quite rightly, another proof of that saying

that everything depends on putting the question rightly to Nature. We understand now that our eyes can see to any distance from which light can reach them. Of course, the question whether the light has traveled billions and billions of miles, or only half an inch, makes not the slightest difference to our eyes.

It is quite a distinct question at what distance our eyes can distinguish the details of a particular thing. This depends on a great many things, but it can be reckoned to some extent, and it is very important to do this in the case of different telescopes. We know that if there were any building on the side of the moon next to us as large as the Capitol at Washington, it could be made out in our best telescopes.

WHY CANNOT WE FLY IN THE AIR AS WE SWIM IN THE WATER?

This is a very just question, because the two problems of swimming and flying are exactly the same in principle. In both cases, the body is heavier than the thing around it, and the problem is, somehow or other, to prevent it from sinking. But, in the case of swimming, the thing around the body, or *medium*, as we call it, is much nearer the heaviness of the body itself than in the case of air, and so the task is much less difficult. It is still less difficult in sea-water than in fresh, because sea-water is heavier. It is possible, however, for an animal that is not a bird, and that is made on very much the same principles as ourselves, to fly; and that animal is the bat. The bat knows, so to speak, as the aeroplane builders know, that if we want to fly, we must expose a large surface to the air, so as to get all we can out of the supporting power of the air.

So the bat, that has fingers of the same pattern as our own, has made them enormously long, and has stretched a web between them, and, thus provided with two beautiful aeroplanes, it can fly. We really see the same thing, as regards swimming, in the case of many web-footed birds, web-footed frogs and newts, and other similar creatures.

HOW IS IT THAT A BIRD CAN FLY WHEN IT IS HEAVIER THAN AIR?

People who spend their lives in destroying the lives of other creatures know that, when a bird is shot, it falls; in other words, a dead bird obeys the force of gravitation exactly as a hailstone, or a raindrop, or a meteor must. The force of gravitation is always acting even on the living bird. It is therefore plain that some force is produced that acts against the force of gravitation, balances it when the bird maintains its level in the air, or more than balances it when the bird rises in the air. This force, as we have seen, is produced by the life of the bird. It can be produced in other things that are not alive, as in a flying-machine, whether a real one, or one of the toy butterflies that we play with. In any case, there is produced a force that acts in the opposite direction to the force of gravitation, and is, for the time being, superior to it. We know that, in the case of the bird, the force is produced by burning the sugar in its muscles; in the case of the aeroplane, it is produced by burning the petrol in the engine; in the case of the toy butterfly, it was produced by burning the sugar in our muscles when we wound it up. Foolish people sometimes speak as if these were cases of defying one of Nature's laws. They are nothing of the sort. Gravitation goes on acting on the bird, whether the bird rises or falls. But, when the bird rises, a greater force is being opposed to the force of gravitation.

IF THE EARTH IS SHRINKING, SHALL WE EVER BE TOPPLED OFF?

When the earth or anything else shrinks, the stuff, or matter, in it gets no less; it is merely packed more closely. What keeps us on the earth is its gravitation, and that depends upon the matter in it. The matter is there just the same, however much the earth shrinks, and the force of gravitation at the surface, and therefore upon us, will indeed be more powerful as the earth shrinks, simply because this must mean that we get nearer to the great mass of it.

There will be a limit in any case to the extent to which the earth shrinks, just as there is to the shrinking of other things. The more anything shrinks, the more resistance there is to its shrinking any more. When anything begins to shrink, we must imagine that there is plenty of room between its atoms, and, as it shrinks, they get nearer to each other; but soon there is less room between them, and the time will come when the force of the atoms, squeezing against each other, will resist the force

that is making the thing shrink. When the two forces balance one another, it will shrink no more. We see this at once if we watch any crowd gather; it goes on shrinking until elbows begin to press against elbows, and then it stops.

WHAT MAKES TREES TURN INTO COAL WHEN THEY SINK INTO THE GROUND?

Not every kind of tree turns into coal, and we all know that coal is of many different kinds. It is not yet quite easy to make out all the reasons why various kinds of coal differ. We have to reckon with many facts, such as the particular kind of plant from which the coal was made, the amount of pressure to which it has been subjected, the temperature at which it has been kept, the kind of salts that were in the water that has trickled through it, and so on.

But still, this question can be fully answered in general terms. We may say that the difference between the tree and coal is, that the tree consists of a great many elements and compounds, while coal consists mainly of the element carbon only. Another way of putting our question, then, would be, What makes everything but the carbon go? The answer is, that the rest of the body of the tree is slowly oxidized, or burned away, but the conditions which obtain in the ground are such, that while the rest is burned away, the carbon is not, and so it remains and forms coal. We see, when we burn a candle, that carbon is more difficult than other things to burn away. We know what a lot of black smoke and soot is likely to come from a candle, or from a lamp. That is the carbon which we have not succeeded in burning; but, certainly, we shall not find any unburned hydrogen.

WHAT IS PEAT AND HOW WAS IT MADE?

Peat, we may say, is half-way between trees and coal. It is made, of course, from vegetable matter, and we may find it in layers many feet thick. About one-seventh of the whole surface of Ireland is occupied by bogs in which the formation of peat has occured, or is occuring. It is said that an inch or two of peat forms every year. We do not suppose that peat is made from just the same kind of plant as most of the coal that we know so well was made from, but still, the process that goes on is really the same. Peat varies a good deal, according to the extent to which part of it has been gradually oxidized away and the carbon left. On the average, about three-fifths of it consists of carbon. When dried, of course, it can be burned.

WHAT IS THE WILL-O'-THE-WISP?

There is a particular kind of gas that is produced from decaying vegetable matter in marshy water, and is called marsh-gas. This is made of carbon and hydrogen, and is readily capable of being burned. As it is produced, it is slowly burned in the air, and so gives rise to a light. The gas, as it burns, shares in the general movements of the air, and so, of course, the light seems to dance about. This is a thing that has long been observed. It has an old Latin name that we may often see in print—*ignis fatuus*. It is also sometimes called Jack-o'-lantern. We can understand how stories might be made up about this light cheating travelers and dragging them into the marsh, where, perhaps, they would fall and die. At one time it was supposed that there might be some kind of tiny insects that hover over marshes at night, and give out a faint light. We know, of course, that there are insects that give out light, like the fire-flies. But it is now generally admitted that the slow burning of marsh-gas is the real cause of the will-o'-the-wisp.

WHERE DOES RUBBER COME FROM?

Rubber is simply the sap or juice of certain trees and plants. Centuries ago, when Columbus discovered the island of Haiti, he found the people using balls of solid sap that they had taken from the trees, but he did not see that it was a product of any importance. It was not until the end of the eighteenth century that it was known in Europe or in North America.

It was first known under the name of elastic gum, and it was brought to us because it was found to be a good thing for rubbing out pencil-marks made on paper.

To-day, rubber manufacture is one of the most important trades in the world. Rubber is grown in various parts of Africa, in America, in Portugal, in British India, in Ceylon, and in many other places. Seeds of the best trees are taken every year to favorable climates, and, everywhere, the growth of the rubber-trees is extending. When the

tree reaches its prime, the rubber-gatherers cut rings in its bark. Soon, the sap begins to flow from these openings, and trickles down into pots placed at the foot of the tree. A good tree gives about twenty gallons of juice, or forty pounds of rubber, in a season. Then it will go on growing again, heal the wounds in its bark, and be ready to be tapped in the next following season. When the rubber leaves the tree it looks like thin cream. It hardens on meeting the air, and, when solid, is sent to market.

HOW IS RUBBER PREPARED FOR USE?

In the factory, rubber undergoes what is called a vulcanizing process. Sulphur is mixed with it, and the mixture is made very hot. Then it becomes more elastic, and very hard. That is what is needed for tires of motors, carriages, and bicycles; for hose-pipes, springs, buffers, gas- and water-pipes, door-mats, dolls, machine-belting, waterproofs, cushions, beds, and so forth. Mixed with a larger quantity of sulphur, and made still more hot, the rubber becomes vulcanite, or ebonite, from which we make combs, pipe-stems, speaking-tubes, instruments that doctors use, telephone mouthpieces, and other electrical appliances.

Rubber is needed for so many purposes that we can never get too much of it, and clever men are working, day after day, trying to discover how to make it. They can make sugar and indigo, and many other things that formerly they could get only from Nature, and they can make rubber, too. But the rubber that the clever chemists make costs so much that it is cheaper to buy that which grows in the forests. Some day men may be able to make it so cheaply that we shall not have to fear a rubber famine. Then tires and rubber dolls will be cheap, and perhaps we shall be able to have our streets paved with rubber, and so put an end to much of the noise of the traffic.

COULD WE SEE WITHOUT THE BRAIN?

The sight is entirely under the control of the brain, and is not perfect at first. All little babies, especially during the first few weeks of their lives, squint a great deal, and often the mothers are alarmed. But there is really no reason for getting frightened about this. After all, it is the most natural thing in the world. The brain is wonderful beyond all other things in earth, or sea, or sky, but it must learn. The tiny little spot in the baby's brain that has twelve muscles to look after, six for each eyeball, can hardly be expected to manage such a team all at once. Yet, in only a few weeks of practice, even the tiny brain of a baby learns how to control all this wonderful living machinery. It can send just the right kind of command along its nerve to one muscle, a different command along another nerve to another muscle, still a different kind of command, that it shall relax and let the others pull, along yet another nerve to yet another muscle, and so on, in perfect harmony, with all the twelve, so that the two eyeballs may move up and down together, or to left and to right, or, what is more wonderful and difficult still, combine these and move both to left and upwards together. We, all of us, do this thousands of times every day of our lives, and yet many people have never given it a thought.

WHY DO WE SEE ONLY ONE THING WHEN WE LOOK AT IT WITH BOTH EYES?

The answer to this question can be guessed directly we make a very simple experiment on ourselves. Let us look at something with both eyes—say, at the outlines of the window-panes. Then let us press sideways with our finger on one eye, so as to push it forcibly a little way inwards or outwards. We shall find that we see double. This can only mean that, directly we interfere with the natural way in which the brain controls the movements of the two eyeballs, we see double.

Each eyeball has six little muscles attached to it, that pull it in the direction the brain desires; the nerves that run to the twelve muscles of the two eyeballs are all controlled by *one* little group of nerve-cells in the brain. The curtains at the backs of the two eyes have corresponding parts, so that images thrown on corresponding parts of the two curtains are *seen* by the brain as one image; but when the eyes are not properly worked together—as when we press on our eyeball—the two images of the thing we look at are not thrown on exactly corresponding parts of the two screens, or curtains, of the two eyes; and so we see two images of the thing instead of one. If we think of it, we shall understand how

wonderful this is, for, when we look at something on our left or right, it must be that the outer part of one screen corresponds not to the outer but to the inner part of the screen in the other eye.

WHY DO SOME PEOPLE NOT SEE STRAIGHT?

When the two eyes are not moved perfectly together, we say that the person squints; and if such a person *took notice* of what both eyes told him he would see everything double, because he would never get the two images of anything he looked at thrown upon the corresponding parts of the screens at the back of his two eyes. But, as a rule, such a person gets into the way of taking no notice of what he sees with one of his eyes, and of really using only the other. So he does not see double.

The commonest reason why people squint is, that one eye is perhaps short-sighted, and the short-sighted eye gives such blurred views of things compared with the other that the brain, so to speak, makes up its mind that it is not worth while to use that eye at all. So it simply gives up taking the trouble of moving that eye along with the other one, and so the person squints. The way to prevent this from happening is to use spectacles, with glasses of different shapes for the two eyes, so that their vision is made equal. Then, of course, the brain finds it well worth while to move both eyes together.

HOW IS IT THAT GRAVITY DOES NOT PULL THE STARS TO THE EARTH?

Everywhere and always, gravity is pulling every atom of matter in the universe towards every other atom. If, therefore, there were no other force at work in the universe except gravity, all the matter in the universe—stars and sun and planets and moons, and everything else—would certainly and quickly be gathered together into one huge round ball. But, while gravity is constantly working, other things are at work too, and what happens in this case, as in every other, is the result of the balance, the give-and-take, the interplay, as we say, between the forces that are at work.

One of the forces at work in the universe is the motion of the various moving things in it, and that motion is, of course, a force opposing gravity on all sides, except the gravity due to anything towards which the body is directly moving. It is the earth's motion, for instance, that prevents the earth from rushing into the sun; and the earth's actual path is the result of the compromise between the motion that is in the earth, and the sun's pull. It has been supposed, by some thinkers, that most or all of the motions in the universe will waste away in time; not that anything is ever lost, but that they may be frittered away as heat. If this were to happen some day, then gravitation, being unopposed, must necessarily pull everything together, and form the great ball we spoke of above. But there are so many other forces at work in the universe than those we have already clearly found out that we must not make any positive prophecies.

CAN THE WORLD GO ON IN ITS PRESENT FORM FOR EVER?

We are certain that, unless the sun should rush into another star, and make so much heat as to burn us all up—which is very unlikely—the earth will go on much as it is now for many ages to come; yet slow changes are always going on, and going on *in one direction*, that must lead to great results some day. The earth *must* be either getting cooler, or else using up the radium that keeps it warm; it is bound to become cold some day, as is the sun itself. That day may be far off—farther off than we are now from the time when the earth was formed—but it must come some time. Then there is evidence to show that the motion of the earth must be getting slower—though very slowly; and probably at last the earth will be drawn into the sun, and so end its independent history. Recent discoveries have made us form longer estimates of the time that these changes will take to happen; but it seems certain that they must happen some day.

WHY WON'T A PENDULUM SWING FOR EVER?

This question seems to assume that we might expect a pendulum to swing for ever unless something stopped it, and that is what makes it so good a question. If a thing moves, something has moved it. If the moving thing stops, something has stopped it. So our question is this: As a moving thing, such as a pendulum, must swing for ever unless something stops it, what stops it?

The things that stop a pendulum are, first, the resistance of the air. That we can understand, if we think of a pendulum swinging in an ocean of water instead of an ocean of air. If we make a vacuum, as nearly as we can, by sucking the air out of a space, and then swing a pendulum in it, it will swing for a long time. Only one thing remains to stop it, and that is the rubbing, or friction, between the top of the pendulum and the thing from which it hangs. So now we know the two causes that stop a pendulum.

WHAT MAKES THE FIELDS WHITE WITH MIST AT NIGHT IN THE HOT WEATHER?

The mist, of course, is water, and it is not water-vapor, or gas, but drops of liquid water. It is exactly the same as a cloud, and if we pass through a cloud in a balloon, it looks just the same as this kind of mist. The hotter the air is, the more water-vapor it can hold. If the air is made very hot by the sun in the daytime, and if there is much water near, and little wind, then the air, as the day goes on, comes to hold a very large quantity of water-vapor. This is a transparent gas, mixed with the other transparent gases that make the air, and so, of course, we cannot see it. But, as the sun sets, the air quickly becomes cooler. Then it cannot hold as much water-vapor as it did before, and so a good deal of the water turns into liquid drops, and makes a mist, just like the mist our breath makes on a cold day. If there is much moisture in the ground, this mist naturally forms nearest the ground, and so looks like a sea of steam. It may be a very shallow sea round our legs, so that we can see clearly above it far away, but cannot see our own feet if we are walking through it.

WHY DOES A PIECE OF IRON TURN RED WHEN IT IS HOT?

When iron turns red, this means, we know, that it is producing light of the particular kind that impresses our eyes as red, and we see the iron by this light. Of course, we see the iron when it is cold, but only by light reflected from its surface. If the cold iron be put in the dark, we cannot see it, but red-hot iron glows in the dark. The point is, then, that the red-hot iron shines by its own light---makes light of its own. Lumen is a Latin word for light, and so we say that the iron becomes luminous. The particular character of the light given out by the iron will depend upon how hot it is, for we know that if red-hot iron is heated it turns white. This fact about iron is common to most things, or, indeed, all things; when they are heated up to a certain point, they become luminous. Light, we know, is made of waves in the ether, and all we can say is, that the atoms of a hot thing move about so as to make those waves in the ether that we call light.

WHY DOES A KETTLE NOT BECOME RED HOT WHEN IT IS HEATED?

If we have read the answer to the last question we shall be prepared to answer this one for ourselves; and the first thing that we shall notice is, that the question is not properly asked, for if we simply take a kettle and heat it, it *does* turn red hot. But what was meant, when this question was asked, was: How is it that the same kettle—which, of course, heated by itself would turn red hot—does not turn red hot when it is put on the fire, *after having been filled with water*?

Well, we know that the reason why a thing gives out light is, that it is hot. So it must be that, in some way, though we are applying heat to the kettle, it does not get hold of enough heat to make it luminous. The reason is, that water will hold more heat than any other thing we know, and that nothing is greedier of any heat in its neighborhood. So the water takes the heat from the kettle, and does not allow the bottom of the kettle ever to get hotter than the temperature of boiling water. That is hotter than our fingers like, but it is much below the temperature at which iron becomes luminous.

WHY IS IT THAT WE HAVE BONES IN OUR BODIES?

The first use of our bones is, by their strength and resistance, to form a supporting framework for our bodies, and prevent them from collapsing in a shapeless mass on the surface of the ground under the influence of the earth's gravitation; that is what would happen to a boneless man, if there could be such a person; and if we had both our legs broken, we should soon find how useful whole bones are in resisting the pull of the earth, which we could not resist in such a plight as that suggested. Even apart from the pull of the earth, our skeleton is necessary to hold the

body in its shape; and so fishes, too, have bones. When we are eating a herring, we object to the bones, but if there were no bones there would be no herring. The second use of our bones is to furnish rigid bars on which our muscles can pull. One end of the muscle is attached to one bone, say, the bone of the upper arm, and the other end to another, such as one of the bones of the forearm, and then, when the muscle shortens, the joint between the bones is bent, and we can lift what is in the hand. Our muscles could not be the wonderful servants of our wills that they are if we had no bones.

And, lastly, the red cells of our blood, without which we could not breathe, are made in the living marrow of most of our bones.

WILL THE EARTH EVER SHRINK UP TO NOTHING?

We believe that, though everything in the universe is *changed*, nothing is ever destroyed and made into nothing. Almost the first fact men realized when they began to think—and to-day we are surer of it than ever—is that nothing is made out of nothing, and that nothing is reduced to nothing. The answer to the question must therefore be, No. If the earth were ever to cease to exist, it would be either because it fell into some other world, such as the sun, or because it kept on losing bits of itself until nothing was left. It could never become nothing by shrinking, as we see directly we remember what shrinking is.

Shrinking means becoming smaller in size, or bulk, or volume. If a thing is packed tighter together, it shrinks; it becomes less in size, but it does not grow any less in the amount of stuff in it. A metal ball shrinks when it is cooled, and expands when it is heated; but there is just the same amount of stuff in it. It merely becomes denser—smaller, but *heavier in proportion to its size.* That is exactly what is happening to the earth as it cools. It is losing to the outer world hardly any of the stuff that makes it; it is daily gaining, by the stuff of all the shooting stars and dust from space that fall upon it. Apart from this, it is simply becoming more tightly packed together.

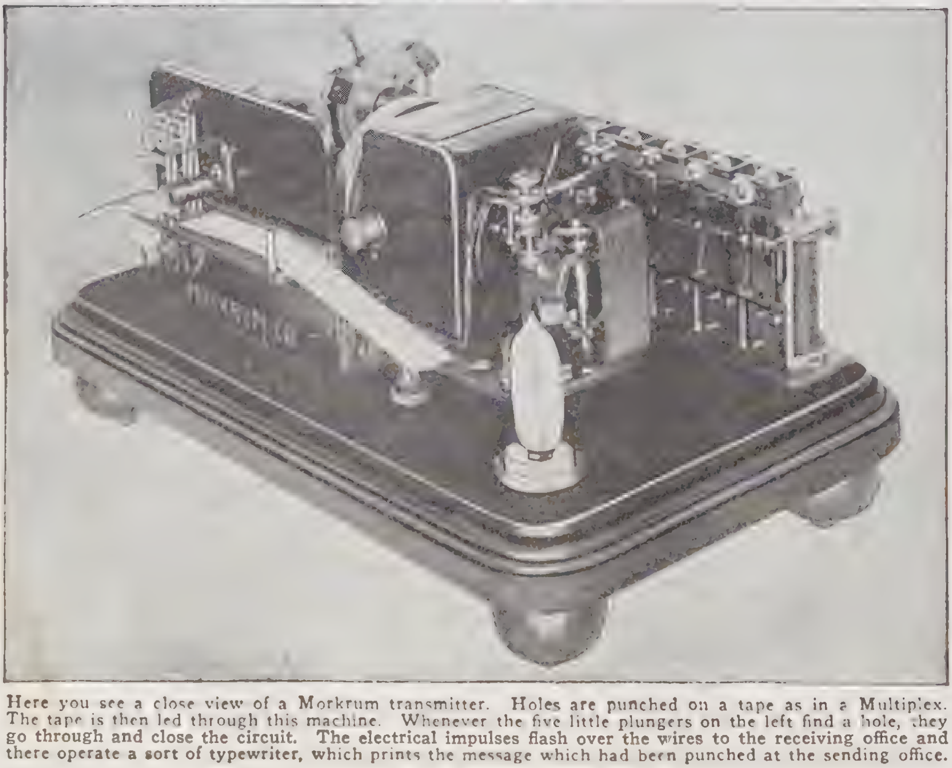
This photograph shows a bank of mist filling a valley, and gradually enveloping a hill.

We may have heard stories about things shrinking away to nothing, but they are absurd. That cannot happen, unless the thing is gradually losing more and more of itself to the world around it. If that went on it would come to nothing; but that would not be shrinking.

THE NEXT QUESTIONS ARE ON PAGE 3677.

THE PRINTING TELEGRAPHS AT WORK

The Multiplex Printing Telegraph machine does not require regular telegraph operators. There is a typewriter keyboard in front of each of these men and women, and as he or she strikes the keys, holes are punched in particular positions on a tape as it passes through. By a clever device, several different messages can be sent at the same time. The speed is much greater than can be reached with key and sounder.



Here you see a close view of a Morkrum transmitter. Holes are punched on a tape as in a Multiplex. The tape is then led through this machine. Whenever the five little plungers on the left find a hole, they go through and close the circuit. The electrical impulses flash over the wires to the receiving office and there operate a sort of typewriter, which prints the message which had been punched at the sending office.

HOW THE SHIPS OF THE BRITISH NAVY AR

The world is becoming a more wonderful place to live in every day. We can speak to people hundreds of miles away; we can send messages round the world in less than five minutes. In this picture, the artist has tried to show one of the greatest marvels that the mind of man has yet achieved. Upon the dome of the British Admiralty Office is a mysterious entanglement of wires which must have puzzled many passers-by. These wires are part of one of the great wonders of our time; they mean that men can sit in a room in London and be in touch with ships more than a thousand miles away. It is wireless telegraphy that has made it possible for men thus to sit under the dome in Whitehall and watch over the British Navy 1,500 miles away, as a

shepherd, seated on a hillside, wa
The artist has tried to show us ho
admirals and naval lords studying
a part of Canada, as well as the B
at this map on the table, we shall
larger picture map with all the w
models of ships, placed exactly as
Clifden in Ireland, at Poldhu in C
are wireless telegraph stations, t
the air, or receive a message flas

WATCHED FROM A TABLE 1,500 MILES AWAY

er his flock in the fields around him. done. Grouped around a table are which shows the Atlantic Ocean and es and a part of Europe. If we look it represents in every particular the sea. Arranged on the map are tiny s themselves are placed at sea. At and at Culver in the Isle of Wight, a ship can flash a message through em. All these stations are also in communication with London, and their messages, carried by the mysterious electricity in the air, come to the wires we see above the tower. From there, the messages are received in the telegraph room, and immediately given to the watchers by the table. Thus, by means of the model ships, the watchers at the Admiralty can tell at any moment exactly where the vessels are, and can instruct their commanders, by flashing messages to them, to hasten home to the island shores in case of danger, or to go to some other part of the far-spread empire. So it may be said that the eyes of the Admiralty see 1,500 miles away, and that the men standing in this room in London can actually command the movements of a naval battle far off in the Atlantic Ocean.

CLASS OF SERVICE	SYMBOL
Day Message	
Day Letter	Blue
Night Message	Nite
Night Letter	N L

If none of these three symbols appears after the check (number of words) this is a day message. Otherwise its character is indicated by the symbol appearing after the check.

WESTERN UNION TELEGRAM

NEWCOMB CARLTON, PRESIDENT GEORGE W. E. ATKINS, FIRST VICE-PRESIDENT

RECEIVED AT 54 WEST 45TH STREET, NEW YORK

FI 54 West 45th St. N.Y. JUN 1 1918

NO. 1 MV 20

TO THE READERS OF THE BOOK OF KNOWLEDGE

MAY YOU AND YOUR FRIENDS SPEND MANY DELIGHTFUL HOURS READING THESE WONDERFUL VOLUMES. THEY WILL MAKE YOU HAPPY AND WISE.

THE EDITORS

HOW WE SEND A TELEGRAM

CONTINUED FROM 3487

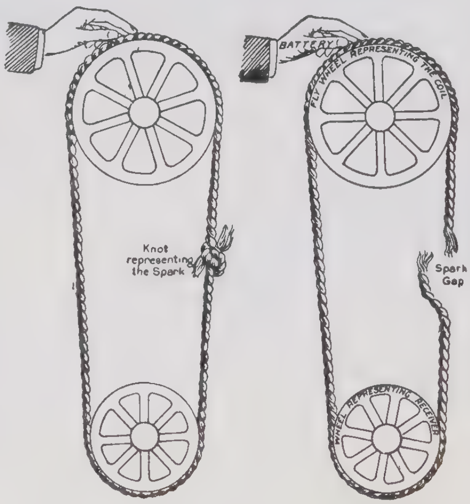
NOBODY can say what electricity really is. It is not matter. It cannot be seen, though its effects can; it cannot be smelt or tasted. We call it a fluid because we cannot give it a better name. But though we do not know what it is, we know how to bring it into use, how to create or excite it, how to harness it, and make it our most marvelous and obedient servant; and one of the chief wonders electricity performs for us takes place after we hand a telegram to the clerk in a telegraph office. A telegram is one of the familiar things in our lives which are so wonderful that no man can quite understand them.

If we wish to send a telegram from Boston to New York, we must have in the first office a battery from which we can send electricity along wires. The wires coil round a piece of iron, and so long as the current of electricity is passing through the coil the iron acts as a magnet—an electro-magnet, as it is called—and draws other metal to it. The moment the current ceases, the iron is no longer a magnet. When we send the electricity through this coil, we call it magnetizing the coil. The current flies swiftly along the wire, and while it is going the circuit is said to be closed. When the current ceases, the circuit is broken. Now we hand our telegram for New York to the telegraph operator. Before him there is a little lever with a knob at the end. This lever is called a key. While that key is at rest, the circuit is broken. The moment he presses it down, the circuit is closed, and the current races along the telegraph wire. He taps away at his key, and the message flies over the wire, to be written down at the New York office. How is it done? New York is the


Taking a Telegram.

receiving end. Well, at the end of the wire, they have an electro-magnet, made, as we have seen, of wire and iron. A current comes from Boston. It enters the office by the wire. It passes through the coil and makes the iron magnetic. The magnet attracts towards itself a little metal bar working on a lever, and every time this bar comes down towards the magnet, the end of it taps upon a small screw; then when it goes up again it taps on another screw. Each tap that it makes corresponds with something that the clerk in Boston has done at his end of the wire.

The Boston clerk, as we have seen, presses down a key. That key, when at rest, has its knob raised in the air. There is a wire attached to the key. Now, when the key is pressed down, its under side touches another wire. The pressing down of the key joins these two wires together. That closes the circuit. The joining of the two wires instantly causes a current of electricity to flow from the Boston battery over the wire to New York. The instant that the key is allowed to rise from the wire underneath it, the current is stopped, and the circuit is broken. While the current is flowing, the coil and iron in New York become a magnet, that draws towards itself the small metal bar.



This diagram explains the uses of the battery, coil, and wires in the sending of a telegram. The hand stands for the battery, which provides the energy. The big wheel represents the coil, which regulates the electric current to flow as we want it. The rope represents the flow of the current, conveying the energy to the small wheel, which stands for the receiving end. The knot is for the electric spark, which ties the ends of the rope, or current, together, as it were. When the knot is tied, the circuit is closed. When the knot is untied, the circuit is broken. It is the rapid tying and breaking of the spark-knot that produces the electric waves.

Clever men thought out a way of making this of use. They arranged that certain pressures by the sending key should stand for certain letters. We have only to agree once for all that a certain sign shall stand for a certain thing, and then we know what it means. And that is how we got the telegraph's A, B, C. A very short pressure of the key in Boston gives two taps in New York, one very quickly after the other, and a longer pressure gives two taps, but with a longer interval between them. These double tappings, one with a short interval between the taps, and the other with a longer pause, correspond with the dots and dashes of the Morse alphabet, which we see on the opposite page, and with which you can make words yourself.

When we send our telegram from Boston to New York, the operator turns the letters which we have written into telegraphic letters by tapping away at his key in the manner agreed upon. Each tap is registered in New York as it is made. With each pressure upon the key the circuit is closed, and the current flies for a certain length of time, signifying a sign which means part of a letter. Each time the key is at rest in its ordinary position, the current ceases to flow.

But there is a limit to the speed at which a man can tap his key. If he is very skilful and strong he may be able to send as many as forty words a minute. More likely he will not be able to send more than twenty-five. That is not quick enough when the message which he sends, instead of being a little telegram from one of ourselves, is a long one of thousands of words—a speech, or the account of some great event. For this, another system is used. A message of twelve hundred words, for instance, would be divided among, say, ten clerks, each of whom sits before a machine that punches holes in a ribbon of paper, the holes corresponding to the letters of the Morse alphabet. Each clerk punches 120 words of the message, at the rate of 25 words a minute, so that, when the work is divided in this way, the whole message is punched out on the tape, or ribbon, in about five minutes. The ribbon is then run through an elaborate telegraph instrument, called

an automatic transmitter, because it works itself. The ribbon runs through in such a manner that the circuit is closed at each hole in the paper representing a dot or a dash, and the current flows along the line, to be registered at the other end, in ink, upon a tape. By this machine, messages can be sent at the rate of 400 words a minute. The recording of the dots and dashes upon a tape at the receiving end is necessary, because no clerk could write out the message at the rapid rate at which it is received. The writing out is done from the printed dots and dashes on the receiving tape.

The Morse Code.

In some of the largest offices there are printing-telegraphs. The operator sits before a machine, very like a typewriter, and punches the tape as described above. The tape is then put into the transmitter, which sends out the electric impulses to the station to which the message is to go. The impulses, as received there, operate a typewriter which prints the message instead of marking a tape at that end. A machine of this sort may send as many as 125 messages an hour, which is more than twice as many as can be sent by key and sounder.


Delivering a Telegram.

You do not find either of these machines in a small office. Both are expensive, and have so many parts that they may easily get out of order. In a small office, where only a few messages are sent or received in a day, you will find only a simple outfit.

Perhaps the greatest wonder of the telegraph line is the fact that several messages can be sent at the same time. Two messages can be traveling over one wire at the same time from Boston to New York, while two others are coming at the same time over the same wire from New York to Boston. This is done by arranging different strengths of current. The messages that are traveling together from the south to the north are each sent by a current which is of different strength from that of the others, and the same is the case with those coming from the north. Each current goes to a receiver, which takes a current of particular strength.

If we have relatives away over the sea to whom we may wish to telegraph, we can reach them by a message carried by electricity under the sea. Cables run under the Atlantic and Pacific Oceans, under the Mediterranean Sea, the Black Sea, the Indian Ocean, the North Sea, the English Channel, and so forth. There are nearly 300,000 miles of these submarine cables in use, so that we can exchange messages with England, Hawaii, Australia, New Zealand, India, China, and many other countries. The principle is the same as in the land telegraph, but the wires are different, and the rate of telegraphing is slower, as the current passing through these long wires is necessarily weaker, which makes the recording of the messages received a slower operation. We describe the cable in another place.

The speed at which cablegrams can travel is still very great, and messages can be punched on a tape, and the dots and dashes be marked on another tape at the end just as on land. A signal has been sent 8,000 miles under water in a single second. As it costs about twenty-five cents a word to cable across the Atlantic, codes are used by which one word may mean a dozen

or more. Both parties must have a copy of the code. By this means, time and money are saved. Once an English firm cabled to their manager in Victoria, British Columbia, and received the answer in a minute and a half. The distance there and back is 18,000 miles. If all wires were kept clear, and no delay or mishap occurred, it would be possible to send a message around the earth in five minutes.

THE WONDER OF TELEGRAPHING WITHOUT WIRES

Undoubtedly the most wonderful method of telegraphing is that without wires. It has been known for many years that electric waves are carried through the air in all directions, with the speed of light, and this knowledge has been turned to useful purposes. The story of William Marconi is told in another place in our book.

By the use of an instrument called a transmitter, these electric waves can be sent bounding forth through the air in all directions. By making a receiver in tune with the transmitter, we can make that receiver take a message, but it will not hear messages with a different wave length.

Thus, we send a message thousands of miles across the ocean without the help of wires. Here again the rate is slow. Cablegrams run off at the rate of fifty words a minute, but the wireless telegrams go at the rate of only twenty-five words a minute. Some day, of course, this pace will be greatly improved. Wireless telegraphy is one of the great gifts that inventors have given to mankind, and we cannot yet realize the importance of it to the world. The pictures on these pages show how wonderful is the power that wireless telegraphy gives us to speak across the sea, and many times we have had reason to be thankful for this wonderful invention.

THE WIRELESS TIES THE SHIP TO THE LAND

Let us picture to ourselves an immense liner moving slowly from its berth. The quay is crowded with people waving their hands and fluttering handkerchiefs. From the side of the ship, on all the decks, leans a multitude of passengers waving farewell. The space between these two crowds slowly widens. Between ship and shore flows an increasing space of troubled water. The faces of people become indistinct. The sounds die away. Then the engines get to work, and the great ship moves forward, and draws impressively to sea.

The passengers send messages of affection, or of business, to their friends on shore, and perhaps a tiny newspaper, giving the news of the world, may be printed on the ship. Perhaps a fog may roll over the sea some night, and an accident may happen. Perhaps you have heard of some of the many occasions on which lives have been saved through the wireless telegraph.

THE THRILLING STORY OF THE LOSS OF THE TITANIC

One of the most thrilling is the case of the Titanic, the greatest ship afloat at the time. On its first voyage, on the night of April 14, 1912, it struck an iceberg, and sank less than three hours afterward. The wireless operators sent out the cry of distress, S. O. S., and were able to attract the attention of the Carpathia, seventy miles away. Gallant Captain Rostron set out at once and picked up more than 700 of the passengers and crew from the small boats or the rafts near the spot where the Titanic sank. Over 1500, including many distinguished people, were lost.

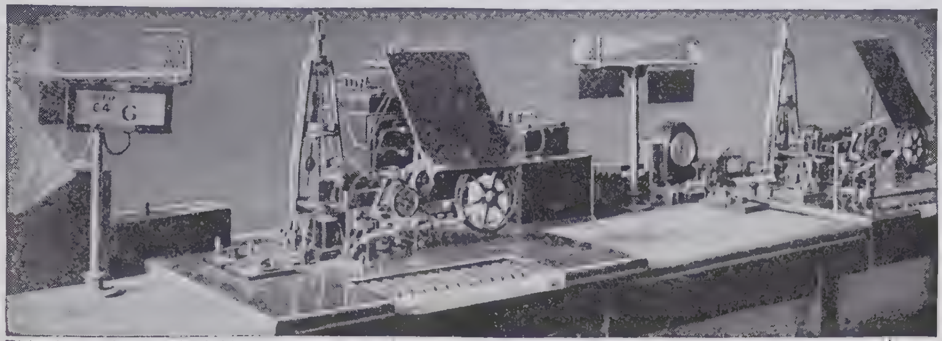
It is a pitiful fact that the Californian was only about ten miles away when the accident occurred, but this boat carried only one wireless operator, who had gone off duty. If he had heard the call, the Californian could have reached the Titanic before it sank, and hundreds more might have been saved. Now all steamers are required to have an operator always on duty, and several times since, help has been called to ships in distress by this means.

SPECIAL USES OF THE WIRELESS TELEGRAPH

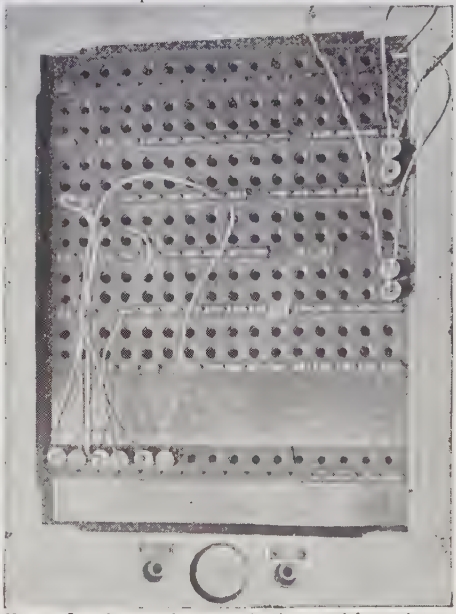
Small wireless outfits are sometimes carried on aeroplanes or balloons, and during the Great War, scouts or observers gave wireless signals to the artillerymen, telling them to aim higher or lower, or to one side or the other. As you may imagine, however, a man high in the air does not stop to send very elaborate messages. Some railroads are equipped with wireless apparatus, and messages are sent to moving trains, as you can see on pages further on. Lighthouses may be equipped to send out danger signals.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 3645.

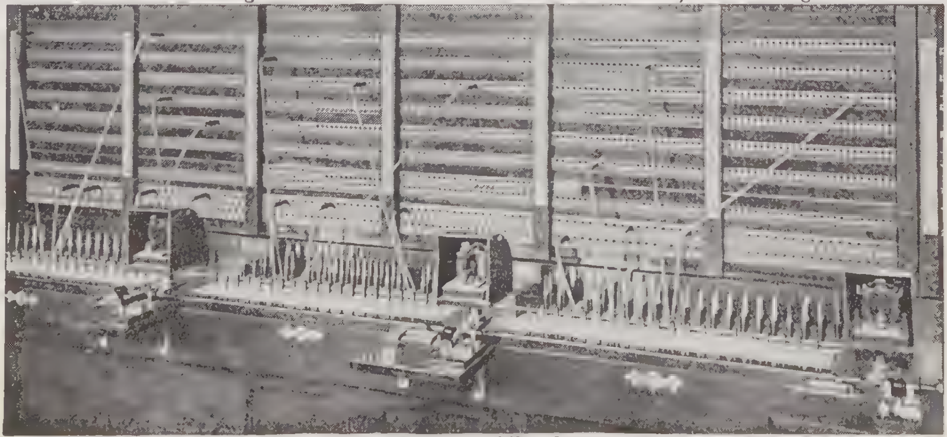
THE CENTRE OF A MILLION MESSAGES



This shows the wonderful instruments by which messages are sent abroad, at the rate of 40 words a minute. The sending is done by a keyboard like a piano, and the machine prints the words at the other end.

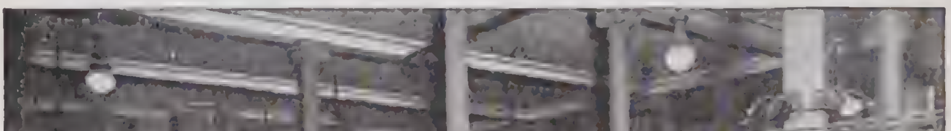


There are about 5,000 wires in the Central Telegraph Office in London, and every wire is tested from time to time to see that it is working well. On the left we see the wires all numbered, and on the right is a test-box.



This is one of the ten sections at the Central Telegraph Office, London, where operators switch through the wires connecting up all Greater London. They work at lightning speed, and have a marvelous knowledge.

On the left is the machine which punches holes in the tape as the keys are struck. This tape is put in a transmitter similar to that shown on page 3574. The machine partly hidden by the two women is printing messages as they come in. The girl behind the other puts in paper, takes out the printed message, and hands it to the one in the foreground, who looks it over to see that it makes sense.



You have noticed in the newspapers, every day, long columns of prices of stocks and bonds. To get these, many wires are connected with New York, and these three operators are here sending all the information to many newspaper offices in different parts of the country. They read the tape and send the messages by key and sounder.

Pictures on pages 3574, 3580, 3581, by Brown Bros.

MESSAGES COMING THROUGH THE SEA

Here is the wireless room in a great ocean steamship. The operator, who is an officer of the ship, is now writing down a message which he is receiving through the instrument fastened over his ears. The tiny click in his ears may mean terrible tidings, or may bring only pleasure. As you see, he has two clocks, for fear that one should stop. The wires, which catch the vibrations, are strung high on the masts outside.

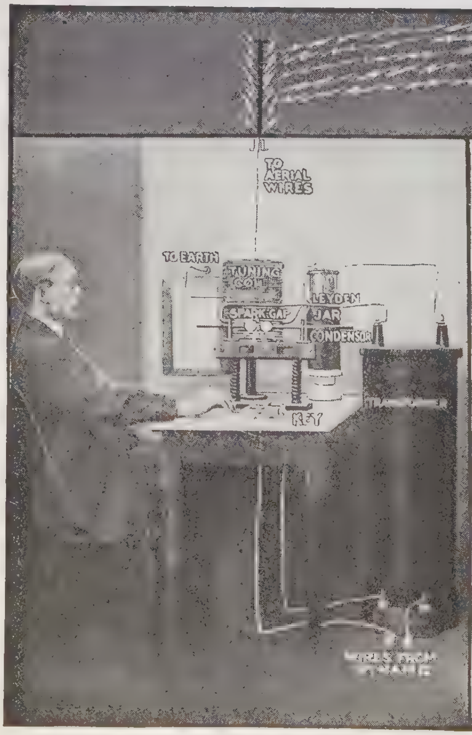
On the table is a siphon recorder, but it is so complicated that I shall not try to tell you how it works. The message, coming under the sea, makes a tiny wavy line on the tape, which the two men in the centre are both translating into words, and are sending by keys and sounders which are hidden by their bodies. The man at the left is writing down what they are saying with their keys in order to keep a record.

TELEGRAPHING FROM A MOVING TRAIN

"WIRELESS" TO A TRAIN GOING A MILE A MINUTE

THIS picture shows a "wireless" telegraph outfit on a train, by which conductor and passengers can send or receive messages without even waiting for the train to slow down. Wireless telegraph stations are set up along the railway line, sixty to one hundred miles apart, and messages can always be sent to or received from at least one of the fixed stations. On the railroad from New York City to Buffalo, the telegraph operators on the train have been able to send and receive "wireless" messages or "radiograms" over more than one hundred miles, though of course they cannot send so far as can the big fixed stations. The "aerial wires" on the train must be kept low so that the cars can pass under bridges and through tunnels. The higher these wires are placed, the farther the station can send and receive. The "wireless" on railroad trains has been very useful in arranging for engines to replace those which have broken down by accident, for substitute conductors, and so forth.

On the right we see the "wireless" station in the railway station. Here a telegraph operator on duty is able to exchange messages with the other operators on the trains and at the other fixed stations in surrounding cities. When a message is received from the train it can be forwarded from the fixed station to almost any point on earth by way of the wire telegraphs, telephones and cables. In the same way, a message may be sent to the train from anywhere, and when it is received at the fixed station by wire telegraph it is relayed or sent out again on the radio ("wireless") telegraph, and travels in the



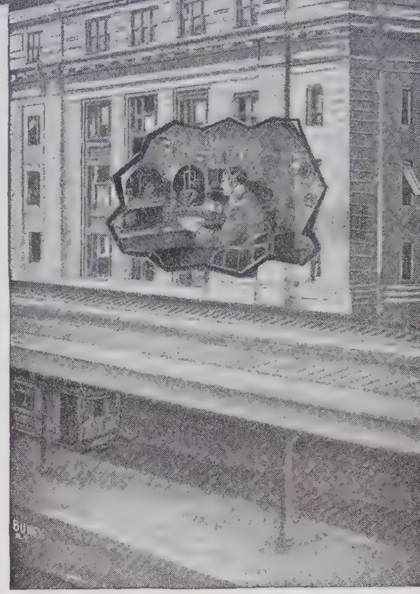
SENDING A MESSAGE BY WIRELESS

HOW THE MESSAGE IS SENT

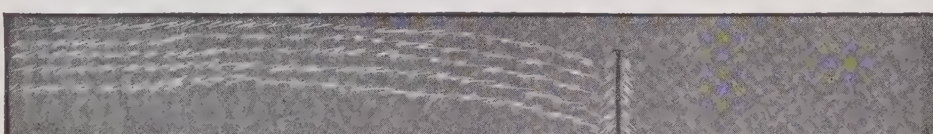
Here we see a radio telegraph (or "wireless") sending outfit. It is called a *radio* transmitter because the ether waves, which carry the messages, are sent out like *rays* in all directions. In the picture, two wires come up through the floor from the power-dynamo (which we must have for any strong radio transmitter), and lead to the telegraph key on the table and to the transformer. The key is held up by a spring, so that until the operator presses down on the knob the current-circuit will have an opening in it and no power from the dynamo will get to the transformer. When the operator presses the key the circuit is completed, and the current flows as long as the key is held on. In passing through the transformer (which is an instrument for increasing or decreasing the pressure of electricity), the pressure of the electrical power is made very high, and this high pressure power is then led to the spark-gap. Whenever the key is held down, a stream of sparks passes across the spark-gap, and the Leyden-jar condenser is first filled with electricity and then emptied. The electricity rushing in and out of this condenser (which is only a glass jar coated inside and outside with tinfoil) passes through the tuning-coil. The action of the current in this coil causes a surging of electricity back and forth from the aerial wires supported up in the air outside the operating room, and connected to the tuning-coil by another wire. On the railroad train the aerial wires are run along the car roofs, and the wire is connected through the wheels to the steel rails. At the fixed stations the aerial wires are held up by high towers, and the ground wire runs down to pipes or sheets of metal buried deep in the earth.

ether through space to the train, where the receiving operator writes it down and delivers it. This *ether* is a wonderful something which we cannot see or feel, but which we believe surrounds and penetrates everything, and which can carry along the "wireless" waves from one station to another.

In radio telegraphy there are no wires to direct the transmitted messages to just one receiving instrument, and every station can hear every word sent by all the transmitters within range. Therefore you will ask at once how it can be that five or six trains or fixed stations are able to telegraph by radio back and forth among themselves at the same time, without getting the messages all mixed up. This is easy to answer: the reason is that although every receiving operator *can* hear everything sent by the transmitting stations in his neighborhood, if he desires to do so, he is not forced to listen to all they send. Each transmitter can be adjusted, by changing the amount of the tuning-coil used, so as to send its messages on only a single wave-length or "tune." Each receiver can be adjusted, in the same way, so that it will receive only the messages sent out on one wave-length or tune. So it is clear that if one pair of stations is using one tune for exchanging messages, another pair may at the same time be using a different tune, and sending and receiving messages without bothering the first two in the least. Of course, sometimes stations are very close to each other, or are very powerful and not carefully tuned; and if this happens there is likely to be some "interference" or difficulty because of confusion of messages. As a rule, however, the train radio service does not suffer much from this interference.

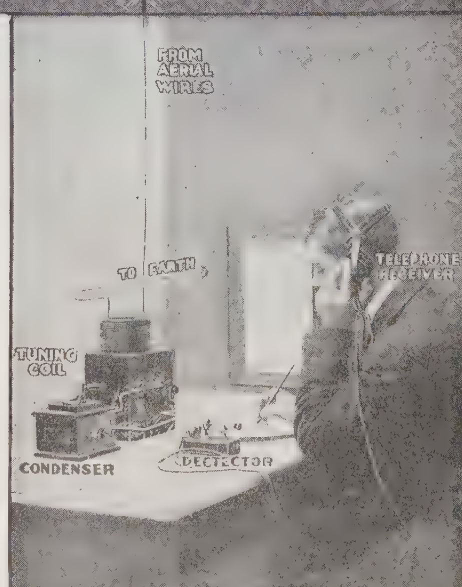


THE OPERATOR IN THE STATION



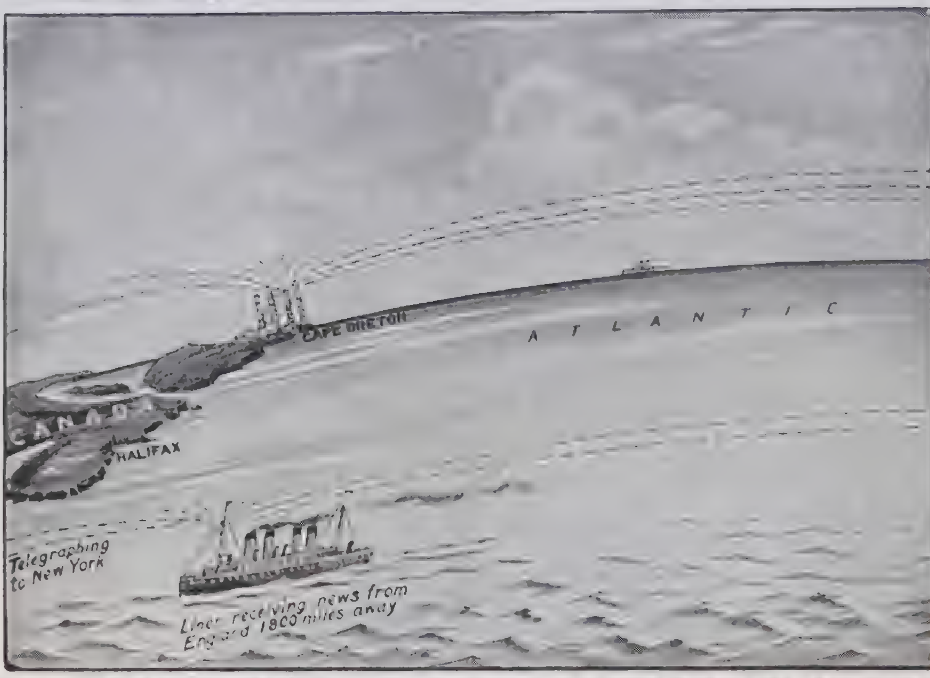
HOW THE MESSAGE IS RECEIVED

On the right is shown a radio receiving station, at which an operator is able to hear messages carried to him by electric waves in the ether. Aerial wires of the same kind used in sending are connected to the receiving tuning-coil, and the electrical circuit is run from there to the earth. Electric waves striking the aerial wires make weak currents in them, and these, running back and forth between the aerial wires and the earth, make other weak currents through the condenser and "*detector*." The little condenser works the same way as the big Leyden-jar at the sender, and along with the "*detector*" (which is a piece of metal, as, for example, zinc oxide clamped in a holder) converts the feeble "received" currents. After this conversion the currents are led to the telephone receivers which the operator wears on his head as do the telephone girls at the telephone exchanges. Holding them close to the ears the operator is able to hear a faint sound whenever the spark jumps across the spark-gap at the sender. When the sending operator presses his key for an instant, sparks pass for a short time, and the receiving operator hears the sound in his telephone for a short time. If the key is pressed for a longer time, sparks pass and the sound is heard for an identical longer time. Thus, the short and long pressures of the key correspond to the dots and dashes of the Morse alphabet, and by their various combinations any message may be sent out. Then, by translating the sounds heard, the operator in the receiving radio telegraph station may once more write down the words of the message, just as if it came over wires in the ordinary way.

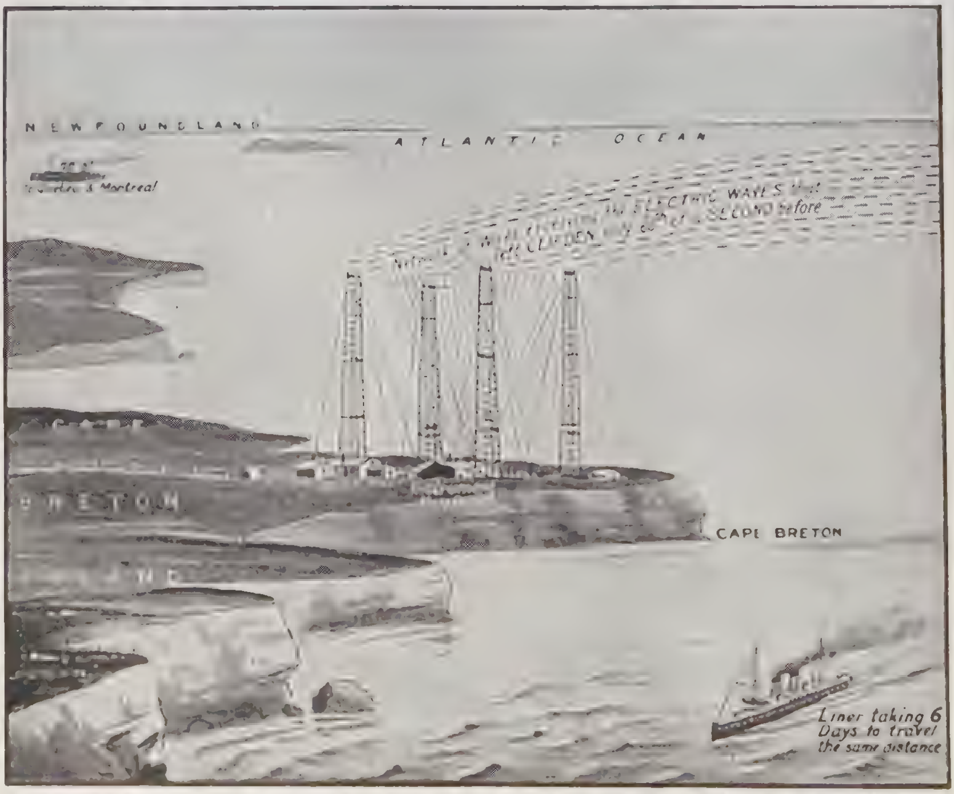


RECEIVING A WIRELESS MESSAGE

MESSAGES THAT FLY THROUGH SPACE

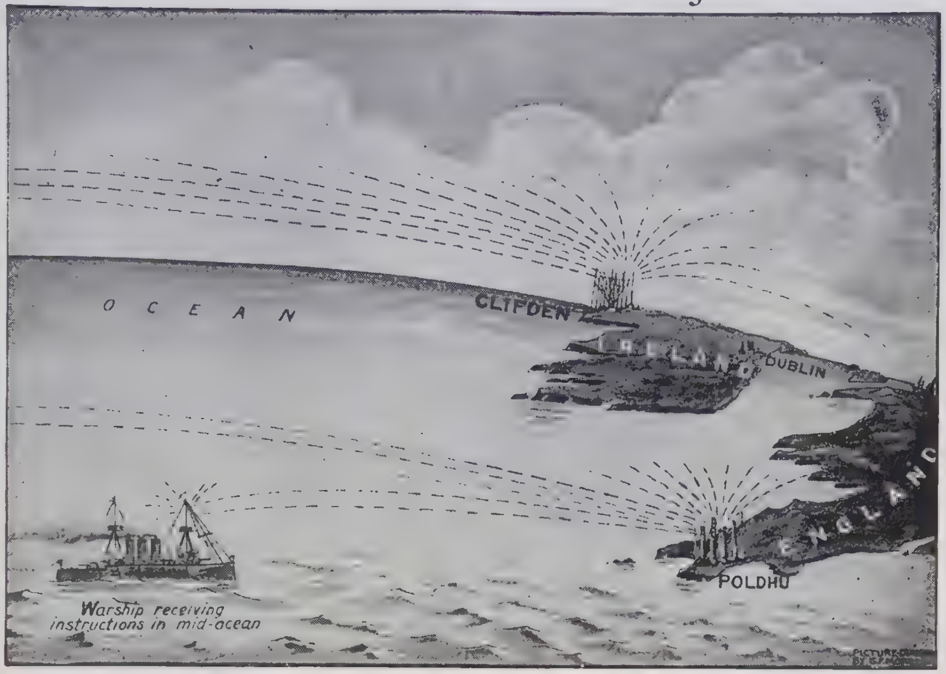


Here we see the latest invention in telegraphy—the wireless system. We tap a key and send a current of electricity along a wire. From the end of this wire the current springs into space and flashes across the sea.



If we want to send a wireless message from Cape Breton to Ireland, on the other side of the Atlantic Ocean, we tap our key, and the message flies through the air, covering the 2,000 miles in the sixtieth of a second.

THE END OF AN ELECTRIC JOURNEY



Not only can we send our messages from Cape Breton station; we can receive messages as well. If we get news for somebody on the sea, we can receive it at Cape Breton and telegraph it out to the ship.

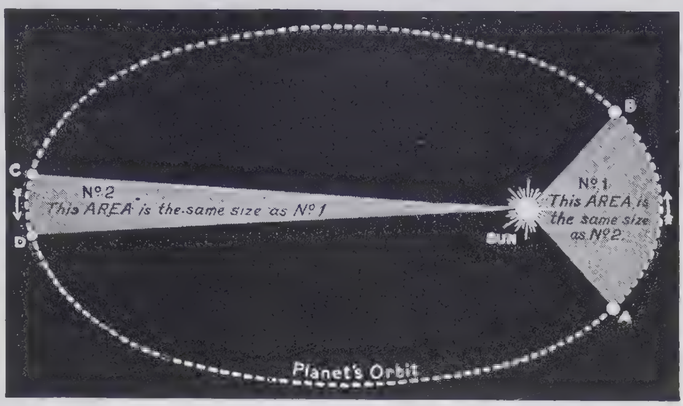
Though we call it wireless telegraphy, we have wires at the receiving and despatching points. High posts are erected at the instrument houses to catch the waves as they fly to us from those who send the message.

A WIRELESS STATION BY DAY AND NIGHT

The structures, with the wires at the top, are built high so that the electric waves, when starting across the sea, may not meet with obstructions. On striking the ocean they leap from crest to crest of the sea-waves.

This picture gives us a glimpse of a wireless telegraphy station by night. Whether it be light or dark, the waves created by the power of electricity speed on their way across the waters. Receiving instruments are ready to record their message, and the words fly, in dots and dashes, speedy as light, and as noiseless.

THE NEXT FAMILIAR THINGS ARE ON PAGE 3645.



This diagram explains Kepler's law that led to the discovery of gravitation. A planet moves along boundaries of equal areas in equal times, and so moves from A to B in the same time as from C to D.

WHY THINGS MOVE

CONTINUED FROM 3430

NEWTON'S three laws are simply called the laws of motion. Kepler's three laws are called the laws of planetary motion; they deal not with motion in general, but with the movements of the planets. With immense labor, continued for many years, Kepler showed that all the planets which were then known moved according to certain laws, their speeds depending upon their distance from the sun, and so forth. The calculations and statements of these laws are rather complicated, and do not matter for us now. There was no obvious connection between the three laws; they were simply three facts about planetary motion that were found by him and put down one after the other. But when the still more glorious mind of Newton considered these facts, he saw that there lay hidden in them the law of gravitation, upon which they all depend.

This law is responsible for perhaps the greater part of all the motion in the world. It is the law, as Herbert Spencer said, "by which the universe is balanced." If the different bodies that make up the universe were still, and were balanced, at rest, by the law of gravitation, that would be wonderful enough. But they are all in motion, and are yet controlled. This great law explains the motions we see in the heavens on one great principle, which applies equally to the motion of an apple let fall from a tree, and of the moon round the earth, and the earth and the other planets round the sun. But, said a great philosopher, we shall never be able to tell whether gravitation exists among the stars. We have now proved, however, that it does exist there also. We can tell the mass and the distance of stars that have never been seen, by the motion which they produce through gravitation in other stars that we can see.

No question of distance, then, destroys the working of this mighty law that every portion of matter in the universe attracts every other portion of matter with a power that depends, in an absolutely regular way, upon the quantity of matter which is being attracted, and upon the distance. This law would alone suffice, if necessary, to make the universe really one.

> All things by immortal power,
> Near or far,
> Hiddenly
> To each other linkéd are,
> That thou canst not stir a flower
> Without troubling of a star.

This is how one of our poets has expressed it, and his lines make it

beautifully clear for us. The same poet, Francis Thompson, has said the same thing, still more beautifully :

I do think my tread,
Stirring the blossoms in the meadow-grass,
Flickers the unwithering stars.

Now, of course, a very serious question for us is whether this great law can be at all changed or altered in its working by anything. We have evidence, as we have seen, that distance does not destroy it at all. But if we come back to earth and study the working of gravitation in the laboratory, can we affect it there ? Many workers, for some years past, have devoted their whole lives to this question.

For instance, if we put something in between two other bodies, do we interfere with the gravitation between them —as if gravitation were something like light, which could be cut off—or does gravitation take no notice of obstacles ? The answer to this, as the result of the most careful study, is that the gravitation between two bodies is exactly the same, their consequent weight and motion, or tendency to motion, being absolutely unaltered by the presence or absence of any obstacle of any kind between them.

THE GREAT FORCE OF GRAVITATION THAT NOTHING WE KNOW CAN STOP

Whether through air, or through water, or through the ether of space alone, whether through intervening blocks of granite, or anything else, the power of gravitation is neither more nor less. If no distance and no obstacles interfere with gravitation, what would be the result of heat ? If we take a thing that has a certain weight owing to the earth's pull for it, and its pull for the earth, and if we examine that same thing, first when it has been made fifty times colder than ice by being plunged in liquid air, and then when it has been made white hot, we find that the influence on the force of gravitation is nothing.

At least, we may put it this way. If we lift this book up in our hands from the table—say, six inches—we increase its distance from the centre of the earth. The book is lighter because the force of gravitation regularly lessens as the distance increases, though no distance will prevent it from working. Now, this difference in the weight of the book, due to its having been lifted six inches, is, of course, extremely slight. But in the newest experiments that have been made on gravitation, we are able to say that if, for instance, heat produced a difference in gravitation as great as the tiny difference produced by lifting the book from the table, we should have detected it. Most people will agree that if tremendous changes in temperature do not affect gravitation even to this extent, probably they do not affect it at all.

ATOMS OF MATTER THAT WEIGH THE SAME WHETHER THEY ARE BOUND OR FREE

We have failed to abolish gravitation by distance ; we have failed to block it by any obstacle ; we cannot affect it by temperature ; but what will happen if we take certain weights of two elements, like oxygen and hydrogen, and then combine them to make water ? In other words, does chemical combination, or, of course, the opposite, which we call decomposition, affect gravitation ? Do all the atoms of two different things weigh exactly the same, no matter whether they are independent of each other, or whether they are powerfully bound to each other, as they are in the case of water ? The answer to this question is that chemical combination and decomposition have no more effect on gravitation than anything else has.

Other ways of trying to affect gravitation have been experimented with. They have all signally failed. We know of nothing that will cause this force to turn one hair's breadth either way from its appointed course. As Sir Joseph Thompson, one of the greatest of living authorities, has lately said, there seems to be no way of getting hold of gravitation. If we could once get our hands on it, we could do anything, but no method that has ever been tried has enabled us to modify it at all. Most people do not in the least understand what this means, however.

A WELL-KNOWN MAN WHO TRIED TO DEFY THE LAW OF GRAVITATION

In a celebrated discussion last century, a very well-known man declared that he could defy the law of gravitation by holding an apple in his hand and preventing it from falling ; but he was opposing force with force, and as long as the law of gravitation acted, he had to pay his price every moment for

holding up the apple. Exactly the same applies to flying-machines. The force of gravitation is always acting, and from moment to moment the flier, like the bird, has to balance this force by some other acting in the opposite direction. The bird gets this force by burning the sugar in its muscles; the aeroplane gets it by burning the petrol in its engines.

STRANGE THINGS THAT WOULD HAPPEN IF WE COULD CONTROL GRAVITATION

But suppose for a moment that in some way we could abolish gravitation, or get hold of it, or cut it off by a screen, then everything would be utterly different. There would be no problem in flying. Neither the bird nor the aeroplane would require to burn any fuel, except just the small amount required to overcome the resistance of the air. There would be nothing to pull the bird or the aeroplane downwards, and an apple released from the hand would not fall until we gave it a smart tap downwards. But one might go on for pages describing the endless extraordinary results that would follow if we could control gravitation. That time may come.

At present, however, not only can we not control it, but we cannot begin to understand it. We can measure it to a nicety, but as to how it acts we know nothing. There are at least twenty-four theories on the subject, and, as Sir Joseph Thompson has said, any one of them may be true; but just because we cannot influence gravitation in any way, we can test none of the theories. There are signs, however, that by working at the problems of electricity we shall ere long be able to go farther than before in this study.

A BOY WHO HELPED THE WORLD BY WATCHING A LAMP SWING IN A CHURCH

At present, however, about 250 years after the discovery of gravitation, we can only say that while we have proved the truth of Newton's law, and its independence of every kind of condition that we can imagine, we know no more of the cause of gravitation than he did, and he knew nothing at all.

It was right to begin with Newton's laws of motion, and then to mention Kepler's laws of planetary motion, as they led up to Newton's great law of gravitation; but we must not forget to do honor to the real beginner of all these inquiries. This was the "starry Galileo," whom we all think of as an astronomer. He was, indeed, one of the greatest of astronomers. But most of his astronomical discoveries depended upon that ingenious mind which enabled him to invent his telescope, and those qualities of mind enabled him also to invent many experiments, so important as to make it true that "the science of motion began to exist with Galileo."

There is a splendid bronze lamp which hangs to-day, as it did in Galileo's time, from the roof of the cathedral at Pisa, and if we watch it we notice that it swings. Watching it at the age of nineteen, Galileo put a finger of one hand on the pulse of the other wrist, and, using this natural clock, he found that always, whether the lamp was making large swings or small, each swing or vibration took exactly the same time as any other. This was a most important discovery in the science of motion, and fifty years later Galileo put it to practical use by making a clock that depended on the constant swing of a pendulum.

WHY THE PENDULUM SWINGS TO AND FRO, AND THE LAW THAT GOVERNS IT

It is worth our while to notice one or two things about the swing of a pendulum. First, there is Galileo's great discovery about the constancy of the rate for any particular pendulum; second, we must ask ourselves where the motion comes from. When the pendulum hangs still, the bob of the pendulum is as near the centre of the earth as it can get. Gravitation is therefore satisfied, and does nothing. But if we start the pendulum swinging, by pushing it or by lifting it to one side and letting it go, then it begins to move.

Why? If we tie a weight to the end of a piece of string and hold the string in our hand, we can study this for ourselves. We see at once that when the bob of the pendulum is at one end of its swing, gravitation demands that it shall fall. In falling it obeys the law of falling bodies, which we shall study in a moment, moving faster and faster, until it reaches its lowest point, but it does not stop there, as we might expect. It does not stop because, in falling, it has come to contain power or energy or motion, and this is sufficient to carry it up again on the other side against the pull of the earth, but always more and

more slowly, because it is doing work against the earth's pull, and therefore losing power. So at last it stops, and then the same thing happens again.

The power in the pendulum is the power that was put into it when it was pushed or lifted. It is not there when the pendulum is at rest, and it has not come from nowhere. The least touch is sufficient to start it swinging, and we may ask ourselves what becomes of that little portion of power that was put into it when it was touched. Now, nothing is lost, and if the pendulum stops swinging, no matter how little the swing ever was, we must account for the power that started it. It goes just as the power goes in a base-ball or a curling stone; it goes in friction where the pendulum is hung, and it goes in the resistance of the air. If, then, we could hang a pendulum so that there was no friction, and if we could swing that pendulum in empty space, instead of in a heavy ocean, which the air really is, it would swing for ever. The power put into it would have no occasion to leak away, and so would remain.

THE WONDERFUL MACHINERY OF YOUR BODY, WHICH NEVER STOPS IN HEALTH

Let us not suppose, however, that this is what is meant by perpetual motion. Directly we asked that pendulum to do any work by turning a wheel or resisting a little air, or anything else, then the power in it would leak away, and it would come to a stop.

Perpetual motion is a phrase which is always used for a certain idea, but few phrases could be worse to express what it means. A healthy child is a case of perpetual motion, and, indeed, whether we are old or young, asleep or awake, parts of our bodies are always moving. So far is perpetual motion from being impossible, that, indeed, the more we learn, the more we find that everything is moving—perhaps even that which we call matter is simply a kind of motion of something. It is almost a question whether there is anything in the world to study except motion, and yet we must have heard it said that perpetual motion is impossible. We should understand what we really mean when we use this phrase. What is impossible is to get something out of nothing, and that is what so-called perpetual motion machines all try to do. For hundreds of years past people have been trying to make machines that would do work for ever without being wound up or without having anything burned inside them.

A MACHINE THAT NO MAN WILL EVER BE ABLE TO MAKE

More than a hundred years ago now, the Paris Academy of Sciences decided that it would take no farther notice in future of any accounts of perpetual motion machines sent to it. At first sight that seems very wrong, because science must always be willing to listen to new things. But it is really quite right, because we know now that no one will ever make a perpetual motion machine. The man who did that would be a Creator.

If power is to be used, it must come from somewhere; if work is done, someone or something must do it. This is true even of the atoms of radium, as it is of everything else. More than that, it is strictly, rigidly true of our own bodies, and of the bodies of all living things. They are a million times more marvelous than any machine that was ever made. Parts of them will work continuously for, perhaps, as long as a hundred years; these machines can repair themselves without stopping; but they are not perpetual motion machines in the sense that this phrase means.

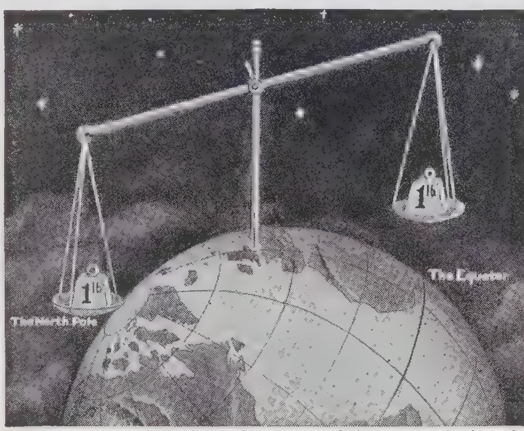
For every heart-beat, for every time that we raise an arm or an eyelid, a certain amount of work has been done, a certain quantity of matter has been moved through a certain distance at a certain speed, and if we know what these figures are, it can be calculated exactly how much carbon, probably in sugar, had to be burned up in the body in order to do that work.

WHY WE MUST BE FED WITH POWER IF WE ARE TO SPEND POWER

If we were perpetual motion machines we could live without food. And the whole point and meaning of the fact that we and all living creatures have to take food, is that we are not perpetual motion machines, but, like every other machine on earth, must be fed with power if we are to spend power. It was long supposed that living creatures were exceptions to this great law, which, as we see, is really the law of the conservation of energy. We now know that

this is not so, and that all living creatures, however wonderful they may be, and however different from things around them, are yet parts of the universal whole, and subject to the same laws. In every generation there are people who will not believe this, and who propose, either by the use of a living creature, or by some kind of machine, to make something out of nothing, but they have always failed, and always must fail.

Now we may go back to another great discovery by Galileo, about which we read on page 318, and we shall see how its meaning fits in with what we have learned about work. By dropping balls of different weights from the leaning tower at Pisa Galileo definitely proved that they reach the ground at the same time. It had been believed for more than two thousand years, on the authority of the celebrated Greek thinker, Aristotle, that a ball weighing ten pounds would reach the ground when a ball weighing five pounds would only have reached halfway. In all that time, so curious is the way in which people used to take things for granted, no one until Galileo had really asked Nature what the truth was.



The nearer anything is to the centre of the earth, the heavier it is. If it were possible to erect a gigantic pair of scales in England and to put a one-pound weight in each pan, one hanging over the Equator and the other over the North Pole, the latter would drop, because it is 26 miles nearer the centre of the earth.

But we must understand this. Surely a big ball, acting upon the earth, and acted upon by the earth, has more power than a little one? Surely we would rather be struck by a small hailstone than by a big meteorite? Surely where there is more power at work there should be greater speed? The answer is yes, there is more power at work, but there is more work to do, for there is more matter to move. The bigger the stone, the greater the power in proportion to the size of the stone; but the amount of work to be done in moving the stone increases in the same proportion, and so all bodies falling under the influence of gravitation fall at the same speed, and for any body whatever, for every second that it falls, its speed is increased in the same degree as in any other case.

Now we shall say that, after all, this is simply not true, because, as everyone knows, a feather takes longer to fall than a stone. But if we could imagine the air swept away, the feather would fall like the stone. This can be proved. We can take a long tube, remove the air from it—or, at any rate, remove quite enough for our purpose—and then let go, say, a bullet and a feather at the same moment from the top of the tube. We find that they reach the bottom together. That was a great discovery, and here is yet another that Galileo made. Aristotle taught that there were two things, weight and lightness; weight or gravity made things fall, and lightness or levity made them rise. Things that had the principle of gravity in them, like a bullet, would fall, and things that had the principle of levity in them, like hot air, would rise, according to Aristotle. Galileo showed that this was untrue. Everything in the universe has gravity in it, just because the law of gravitation applies to all matter everywhere. There is no such thing as a principle of lightness, or levity. Hot air rises, a balloon rises, a cork floats, not because these things have no weight in them, but simply because they have less weight in them than the things around them have, and so the things around them fall in beneath them, so to speak, and push them up.

But the most wonderful thing about Galileo was that he really saw for himself, and without anyone working before to help him, what Newton and the great workers of the nineteenth century proved. He saw that whenever there is motion, there is force, power, or energy at work.

This idea of force as involved in all motion was new to Galileo, and it is the foundation of the whole science of motion. The proper name for the science of motion is dynamics, which is the Greek for force.

ENERGY THAT IS NEVER CREATED AND CAN NEVER BE DESTROYED

The truth is that no one before Galileo seems to have seen that causes must have effects, and effects causes; that big causes must have big effects, and big effects big causes. So, wherever there is much motion, there is a proportionate cause at work. Galileo, of course, wrote in Latin, and used the Latin word *vis*, which means force, and Newton also wrote in Latin, and used the same word; but last century an Englishman, Dr. Thomas Young, began to use the word energy. And we say now that wherever there is motion, there is energy; that this energy is never created and never destroyed, but eternally transformed. These great ideas really date from the mind of Galileo, who actually worked out for himself in a rough way all of Newton's laws of motion. It is very interesting, however, that though both Galileo and Newton must have had in their minds the idea of the conservation of energy, neither of them stated it in so many words, and this was left for some German men of genius in the nineteenth century to discover and formulate.

Energy is energy wherever it is, and in whatever form it is; but it has different forms, and two of these must be understood. The words describing them are certainly rather long, but they are not difficult to understand. When a thing is moving, we say that it has in it energy of motion. The proper name for this, taking the Greek word that means motion, is *kinetic* energy.

THE TWO KINDS OF ENERGY THAT ARE SEEN IN THE SWINGING PENDULUM

There is no difficulty about this. When the bob of the pendulum swings downwards, faster from moment to moment, it is gathering kinetic energy, or energy of motion. Now, the other kind of energy is energy that does not show itself at the moment in anything, but the power or potency of it is there—*potentia* is Latin for power. It is therefore called potential energy. Now, throughout the world we can constantly see potential energy turning into kinetic energy, and *vice versa*. The pendulum is a most beautiful illustration of this. When we pushed or raised the bob of the pendulum, its motion upwards showed kinetic energy; when it ceased moving upwards any farther, that motion was not lost, but was stored up in the bob of the pendulum as potential energy. It did not move, but it had nevertheless within itself the power to move.

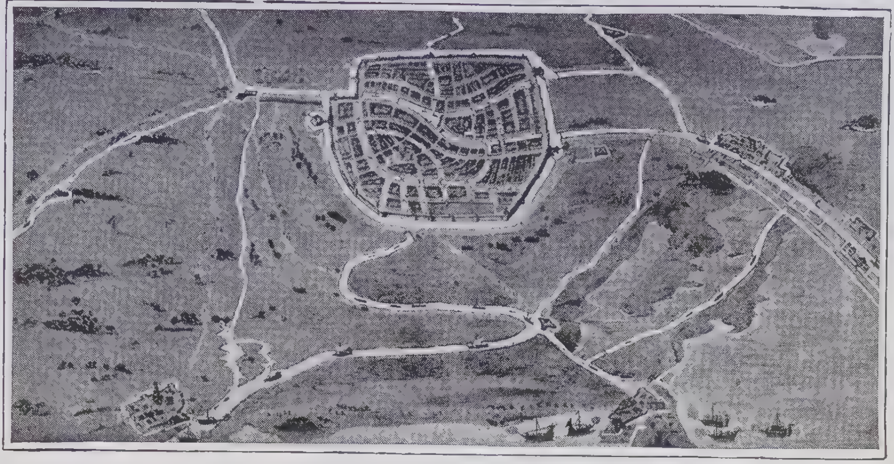
Then, when we let it go, the potential energy was changed into kinetic energy, as its motion proved. This kinetic energy enabled the pendulum to rise again after it had reached its lowest point. And now, at every moment, as the pendulum rises, it moves more slowly; its energy of motion, or kinetic energy, is being changed, though not lost, and when the pendulum reaches its highest point on the other side, all the kinetic energy has been changed into potential energy; and so this transformation backwards and forwards goes on as the pendulum swings.

HOW MEN ARE LEARNING TO GET ENERGY FROM THE SUNSHINE

But we can learn from this still more about the changes of energy. When we pushed or lifted the bob of the pendulum, where did that kinetic energy come from? We have already learned that the living body did not create it; our muscles made this energy of motion out of the potential energy existing in the sugar stored up in the muscles and derived from the food. This kind of potential energy, existing in sugar and other chemical things that can be burned, is sometimes called chemical energy; but it is a kind of potential energy, and can be changed into energy of motion just as in the case of the bob of the pendulum when it is at its highest point.

But where did that potential energy in the sugar come from? Did the plant which made that sugar create that energy? That cannot be, we know. The plant made that potential energy out of the energy of motion, or kinetic energy, of the sunlight which streamed upon it. And we are now learning that that kinetic energy of sunlight probably came in greatest part from the potential energy stored up in the atoms of the sun.

THE NEXT PART OF THIS IS ON PAGE 3671.



HOW THE SEA SAVED HOLLAND

CONTINUED FROM 3296

SET in the midst of pastures, gardens, and orchards, with the Rhine running through the streets in many channels, Leyden, of which we see a plan on this page, was, in May 1574, indeed a beautiful city. But the whole country was disturbed by the Spaniards, who were trying to force their religion on the Protestant Netherlanders. The people of Leyden would not submit, so an army under Valdez was sent to besiege the town. Encouraged in their resistance by the Prince of Orange, the brave little garrison shut the gates of the city, and the inhabitants were put on a strict allowance of food.

Now, Holland is below the level of the sea, which is only kept back, as we read on page 3540, by great dykes. The prince sought means to relieve the besieged ; but, with the Spaniards all around the town and along the coast, there seemed but one way. He could not send ships to Leyden by sea, but he could send the sea to Leyden, and let the ocean drive away the Spaniards. He would pierce the dykes, open the sluices, and so save Holland. The people were willing, and said : " Better a drowned land than a lost land."

And so, in August of that year, the dykes on the coast were burst, and the waters crept down over the country towards the starving city. The Spanish army watched the water rise higher and higher between the dykes, first with surprise, then with alarm. A Dutch fleet of 200 vessels was fitted out and sent towards the city, which was, however, so well protected that it could not be reached for several weeks.

First a strong dyke, the Landscheiding, five miles from the city, was captured and pierced. The boats sailed through the openings, but the next dyke was found still one foot above the water, and when that was breached, the water beyond was too shallow to carry the boats, and they could only advance through a canal which was well guarded by the Spaniards. Alas for starving Leyden ! The brave little fleet was repulsed, for the wind blew the waters back from the city.

On September 8, however, a gale arose from the north-west, and blew for three days, driving the waters nearer to the walls. Then the Spaniards retreated, as the waves, carrying the boats, advanced. Another long delay, due to an easterly wind, and yet the patient citizens, gaunt, feeble, racked by fever and pestilence, refused to yield.

Some of them reproached the burgomaster for not yielding, but his courage and patriotism did not fail, and he answered: "I know that we shall starve to death if we are not soon relieved; but starvation is preferable to the dishonored death which is the only alternative. My life is at your disposal; but expect no surrender so long as I remain alive."

The people gained courage from his words; a dove flew into the city bearing a message of hope, and, on October 1, a gale blew the waters close up to the walls. On the flood floated the relieving fleet, and there was a sharp encounter with the Spaniards, whose boats were sunk. Now the fleet was within a few hundred yards, and the men, jumping out, shouldered the boats through the shallows. There remained but one more fort of the besiegers to be taken. At dead of night the citizens watched lights come out from it and flit across the water.

In the morning a boy was seen at the top frantically waving his cap. He was a Dutch boy, and had seen the Spaniards escape. So the fort was entered, and the fleet swept alongside the quays throwing bread to the starving people. Then men, women, and children went to the cathedral, and thanked God for their deliverance, and, as a monument of their gratitude, they next year founded the famous Leyden University.

THE CLIMB UP THE CAPITOL HILL

WE read, elsewhere, how the beautiful city of Rome was taken and plundered by the Gauls. A story of one of the bravest Roman citizens who lived at that time stands out in the history of that terrible disaster. When Rome was besieged, one of her ablest generals was away from the city, for he had been falsely accused of taking more than his share of the plunder at the capture of Veii, a neighboring city.

Angry and disgusted with the treatment he had received, Camillus had taken up his abode at Ardea. By his ability, he saved this city from destruction by the invading Gauls. When the Romans heard of this exploit they repented, saying: "If only our brave Camillus were here, he might save our city also from the dreadful Brennus." So they sent a message, begging Camillus to return and help them. But Camillus, who was a proud, haughty man, refused, saying that he was only an exile, and would need a decree from the Senate before he returned to Rome.

Now, the senators who were still alive were in the besieged Capitol, which stands high up on the Capitoline Hill, and could not be reached without passing through the Gallic lines; but a patriotic young Roman, Pontius Cominius, offered to undertake the mission.

Dressed as a peasant, and with corks about his neck to keep his head above water, he plunged, one dark night, into the Tiber, and drifted down to the base of the Capitoline Hill. Now came the dangerous part of the venture, for Cominius had to climb up to the Capitol. He clung to grass, vine-stem, or point of rock as he dragged his body up the steep ascent, using his bare feet to aid him, and all the time keeping a sharp look-out for any Gaul on the watch, until at last he reached the rampart. There he called out his name, and was immediately surrounded by his eager countrymen. He told them that Camillus only waited the Senate's decree to come to their help. Camillus was quickly voted Dictator by the few senators who were left, and Cominius at once returned down the hill, luckily escaping without being seen by the Gallic sentinels.

Though he got safely away, the Gauls noticed that someone had disturbed the creepers, and that stones were displaced, so they planned a night attack on the Capitol. When they carried this out they found the sentinel asleep, but the cackling of the sacred geese in the Capitol warned the citizens, and they repulsed the attack. However, the besieged were starving, and were driven to treat with Brennus. While the ransom was being discussed, Camillus, with his soldiers, appeared on the scene, and exclaimed: "It is with iron, not gold, that Romans guard their country."

Soon after, the Gauls were driven away, and the Romans acknowledged that they owed their rescue to the brave Cominius, who, at the risk of his own life, had brought Camillus to them.

THE NEXT GOLDEN DEEDS ARE ON PAGE 3693.